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Col-Gen Yakovlev on Officer Discharges, Reform Status

95UM0324A Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 4-7

[Interview with Colonel General Valentin Alekseyevich Yakovlev, first deputy chief of Russian Federation Ministry of Defense Main Cadres Directorate, by ARMEYSKIY SBORNIK correspondent Lieutenant Colonel Viktor Kutishchev, date, place and occasion not specified, under rubric "Pertinent Interview": "The Person Is at the Center of Reform"; photograph of Yakovlev included]

[FBIS Translated Text] **From his biography.**

Colonel General Valentin Alekseyevich Yakovlev, first deputy chief of Russian Federation Ministry of Defense Main Cadres Directorate.

Born 7 May 1942 in city of Novyy Toryal, Novotoryalskiy Rayon, Mari ASSR. Completed Leningrad Higher Combined Arms Command School imeni S. M. Kirov, Frunze Military Academy and General Staff Military Academy.

Served in positions from platoon commander to naval infantry division commander in Baltic, Black Sea and Pacific fleets. Commanded an army corps in Odessa Military District and was on official TDY as an adviser to the commander, Special Military Area, Socialist Republic of Vietnam People's Army. From September 1991 first deputy chief of Russian Federation Ministry of Defense Main Cadres Training and Assignments Directorate, and from 20 July 1994 first deputy chief of Russian Federation Ministry of Defense Main Cadres Directorate.

The success of military reform—as of any other reform, by the way—depends on how competently and consistently it is carried out locally. The familiar expression "cadres decide everything" has not lost its importance even in our days. Nevertheless, what place does the person in shoulderboards hold today in plans of the Main Cadres Directorate? This was the subject of our journal correspondent's discussion with Colonel General V. Yakovlev, first deputy chief of Russian Federation Ministry of Defense Main Cadres Directorate.

[AS] Comrade Colonel General, historical experience shows that the majority of military reforms began with a reduction in armed forces peacetime numerical strength, and the present reform is no exception. The difference between them is only in the rates. Aren't Russian Army officer personnel being reduced too rapidly?

[Yakovlev] I wish to direct attention to the fact that the decision to reduce the Armed Forces numerical strength was not made by the Ministry of Defense, but by the country's supreme legislative body and government. And it was dictated above all by difficulties connected with maintaining an enormous Army and with excessively large financial expenditures for defense.

With respect to rates of reduction of officer personnel, they are not being accelerated in any way. There is a special plan for discharging servicemen, to which we are adhering. And if it is being fulfilled somewhat ahead of schedule, it is because of so-called table of organization measures as well as because of those officers being discharged from the Army at their own desire or for certain other reasons. So as not to make unsubstantiated statements, I will cite a few figures.

In 1993 it was proposed to discharge 19,674 regular officers from the Army. A total of 69,033 were discharged: 13,823 at the expiration of their term of service, 15,005 in connection with table of organization measures, 10,974 as not meeting requirements established for servicemen, 4,040 for offenses discrediting the honor of a serviceman, and 25,191 because of illness, because it was impossible for a member of his family to live for medical reasons in the locality where this serviceman was performing duty, because of child care and other reasons.

In 1994 15,498 regular officers were to be discharged. There are 26,491 officers already discharged, of whom 6,341 were at the expiration of their term of service, 5,263 in connection with table of organization measures, 2,680 as not meeting requirements established for servicemen, 1,282 for offenses discrediting the honor of a serviceman, and 10,925 for the other reasons indicated earlier.

If we analyze the figures cited, we will see that the number of persons being discharged in connection with expiration of term of service and with table of organization measures on the whole coincides with planned figures.

But there is another side to this problem. Even if the Ministry of Defense did wish to accelerate, as you say, rates of discharge of regular officers from the Armed Forces it would be unable to do this under present conditions. Why? Well, because this would require enormous financial outlays involved with settling with the officers. Moreover, existing legislation would not allow us to do as was done, for example, in the 1960's. At that time over a million regular officers, among whom there were many frontlinesmen, were forced to part with the Army, many without having the right to a pension or housing.

Today, considering the mistakes of the past, we do not have the right to undertake any kind of artificial, let alone compulsory, measures. People should not suffer.

[AS] Valentin Alekseyevich, the previous question was not asked by chance. The mass reduction deprives young officers of confidence in tomorrow, and along with that it also robs further service of meaning. You arrive at that conclusion when you see the ease with which lieutenants and captains part with the Army. This is also indicated by statistics. Platoon commander positions are half vacant in some units. I would like to know whether or not the

Russian Federation Ministry of Defense Main Cadres Directorate predicted such a situation and what is the way out of it?

[Yakovlev] We did not presume such a scale of Armed Forces reform and the table of organization measures connected with this, which entailed the mass discharge of regular officers to the reserve. We simply entered this situation together with the Armed Forces. And I can say why we were in no position to work for the future, as they say. Above all because the political decision in 1991 to reduce the Army by 500,000 persons was made unexpectedly for us. The question of withdrawal of all troops from foreign territories also turned out to be already decided. But the state program for withdrawing Russian troops from abroad and for stationing and settling them in at new duty stations was developed only in 1993. Only then did we manage to realistically determine the presumed number of officers subject to discharge for particular reasons. Relying on specific legal norms of military laws, we began forecasting the complex social processes connected with this.

Officers of the Main Cadres Directorate foresaw that some young officers themselves would wish to part with the Army under the new conditions connected with the economy's transition to market relations. According to the Law "On Military Obligation and Military Service," after five years of service a young officer can be discharged to the reserve or can express a desire to extend his contract with the Ministry of Defense.

Now a few words about the lowest officer positions being understrength in the troops. I have to note that there never have been enough platoon commanders: someone has been appointed to a higher position, someone has been transferred to another unit, someone has been discharged for one reason or another—and the platoon commander's slot remains vacant. This is an ordinary phenomenon. It is another matter that the understrength of lowest officer positions has increased today because of a lack of desire of a particular senior lieutenant or captain to conclude a contract with the Ministry of Defense, but in my view such a situation will not last long. With the conclusion of Armed Forces reform, the number of lowest officer positions will have been reduced significantly. Military higher educational institutions already have received the order and will train the necessary number of specialists.

Such confidence is no accident. This year the competition to get into military educational institutions was 1.6 persons and in some it was over three persons for one training slot. This became possible because of the revival of authority of officer service which has become apparent and also the transition of the higher school to a more advanced multilevel system of education. The fact that, despite all transformations, the Armed Forces remain the most stable state structure with guaranteed "jobs" also plays its role. All this permits the hope that we will succeed in eliminating the chronic understrength of lowest officer positions in the troops in the future.

But there are not enough platoon commanders for now, as you rightly noted. Therefore a call-up for two years for reserve officers having specialties acutely scarce in the Armed Forces is being accomplished in accordance with a Russian Federation Presidential Edict. Of course, this is a temporary, forced measure.

[AS] I know, for example, that in Volga Military District reserve officers who are graduates of civilian higher educational institutions were called up for two years. But does the Army gain much in acquiring two-year reservists? For this already has happened in our recent history. I recall how each day young officers literally counted how long they had remaining until discharge. Will the newly-made platoon commanders wish to conscientiously perform Army toil today?

[Yakovlev] Not everything is as bad as it may seem. Reserve officers called into the Army for two years are performing their constitutional duty—I emphasize duty, not someone's whim. And this cannot be forgotten. Finally, let us recall that there also exists a serviceman's legal responsibility to the state for his affairs and acts, although I will repeat once again that the call-up of reserve officers is a temporary measure caused by real processes of democratization of society and the Army. It will take time to work out a specific mechanism and create that system which would permit regulating processes connected with the Army, including with citizens' performance of their military duty, that are painless for society, for its military organization and for the individual. The ruble, as we say, or to put it differently, financial incentive, should become one of the chief mechanisms in such a system.

[AS] You touched on a pertinent question. At all times, financial incentive has been and remains one of the chief motives for people's acts. In this connection, here is a question that troubles all servicemen today: Will privileges for officers who have served the prescribed term be rescinded in 1995, particularly the one-time allowance for discharge to the reserve as specified by the Law "On the Status of Servicemen"?

[Yakovlev] There have been such rumors. They are engendered by repeated attempts of certain departments to eliminate privileges now existing for servicemen, including the one-time allowance when an officer is discharged to the reserve or retirement. Naturally, such rumors undermine not only servicemen's faith in reforms, but also their desire to serve further. Perhaps this is one reason why many officers are not signing a contract?

But I must say that the position of the Ministry of Defense, Government and President is unequivocal—those privileges which servicemen already enjoy cannot be rescinded.

It is another matter that those legislative acts on social protection of servicemen and their families, which for a

number of reasons just were not realized within prescribed time periods (a mechanism for their fulfillment is absent and so on), can and will be realized as the country's financial situation improves.

[AS] In connection with the theme of our conversation, it is impossible not to touch on the question of contracts concluded by Russian Armed Forces officers on the one hand and by the Ministry of Defense on the other. To what extent has this form of legal relations justified itself?

[Yakovlev] A transition to contract service has not yet been completed, and so it is difficult to respond thoroughly to this question. In accordance with the Russian Federation Law "On Military Obligation and Military Service," this work was supposed to have been completed by the end of last year, but even now I still will not be able to give you a complete answer. The fact is that it seemingly has not become worse for the officer with the signing of a contract, for this document forces both parties to fulfill their obligations. The Ministry of Defense obligates itself to ensure the serviceman all his rights and social guarantees, and at the same time has the right to discharge a person who is not fulfilling the contract terms: for committing an offense discrediting the honor of a serviceman; if a serviceman has ceased to meet established requirements; and in connection with table of organization measures.

And the officer in turn has the right to rescind a contract only in case he is declared to have limited fitness for military service according to a military medical board finding and also when it is impossible for a member of his family to live for medical reasons in the locality in which this serviceman is performing military service.

Now let us take a specific situation: a contract has been signed, but an officer continues to receive pay and allowances which do not permit providing him and his family with a worthy existence. The Ministry of Defense is not providing apartments for servicemen and a place in a kindergarten, nursery and so on as quickly as stipulated in the law. Such is reality. I repeat, little has changed for the majority of officers with the signing of a contract. They still go on duty, travel on TDY and to ranges, and they receive money, but it turns out to be not every month.

[AS] Well, just what is happening? Are we again really passing off what is desired as reality, or is this simply a failed experiment?

[Yakovlev] I would not be hasty with such conclusions. The entire trouble is that we still have not completed work to create a standard base which would give a contract real legal force. To put it more simply, we lack a mechanism for organizing professional military service according to all legal canons, beginning with a guarantee of rights and ending with termination of a contract with restitution for moral, material and other damage by one of the parties (as is done, for example, in armies of civilized states). And I would not begin blaming anyone for this. We simply have neither the opportunity nor the money to do as was done at one time by the Americans, for example. They took almost two decades to shift to a new principle of manning the Army on a professional basis, but even this was not enough for the mechanism of contract service to begin working at full force. Only after having allocated considerable funds for defense needs was the United States able to breathe life into the professional Army. Obviously, something similar also will happen with us, but in shorter time periods. Russia simply has no other way out.

[AS] The success of military reform, as any other reform, depends on how competently and consistently it is implemented locally. We know that in the near future in the course of reform a transfer of combat units to a new table of organization structure is to be completed, new groupings of troops and forces are to be created, a mechanism for organizing contract service is to be adjusted, and much more. In connection with this, readers are interested in plans of the Russian Federation Ministry of Defense Main Cadres Directorate for the future and what place the individual holds in them.

[Yakovlev] The person in shoulderboards and his career always have been and remain the focus of attention of Main Cadres Directorate officers. And these are not simply words. Not only the success of the job, but also the duty of the officer and the well-being of his family depend on proper selection and placement of cadres. I will not begin citing examples, since to one degree or another each serviceman has been able to see the truth of my words from personal experience.

Now we are faced with no less important a task—how to prepare cadres better and more effectively so they meet requirements not only of today, but also of tomorrow. It is a question of young people, of the future of the Russian Army. As I already said, the higher school has gone over to a multilevel system of education. Preparation of cadres for the Army in Suvorov and Nakhimov schools, in cadet corps and in specialized schools prior to attending a higher educational institution acquired special importance under the new concept. Both the training of officer cadres in higher educational institutions and post-university training demand further "breaking in."

Serious attention will be given to the selection and placement of military cadres to positions, including officers at one's disposal; to the precise, substantiated organization of replacement; to timely discharge of officers who have served for the time periods established by law; to retraining of officers discharged to the reserve or retirement and also members of their families for civilian specialties which are in demand under conditions of a market economy; and to other vitally important questions.

So much work lies ahead, and our task is to perform it responsibly and in a well-conceived manner, elevating the authority of officer cadres and returning prestige to military service.

THE ARMY: PROBLEMS, SOLUTIONS

Problems of Air Support to Mobile Forces

95UM0324B Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 8-11

[Article by Colonel (Retired) Aleksandr Krasnov, doctor of military sciences, professor, Air Academy imeni Yu. A. Gagarin: "Aviation and Mobile Forces: There Seem To Be More Questions Here Than Answers"]

[FBIS Translated Text] *The Mobile Forces are a new interbranch operational-strategic force element intended for rapid movement from one region to another to reinforce troop groupings operating there. Highly mobile combat operations also can be conducted with their help in areas where a threat arises to the country's interests and security. The need for such a force element is generated on the one hand by preservation of the NATO military structure, the largest in the world, and on the other hand by the reduction in the Russian Armed Forces, which does not allow having large, previously deployed groupings on all threatened axes. With the disturbance in the balance of forces, this is less burdensome for the state and is effective for defense.*

The Mobile Forces are formed from units and formations of the Ground Troops (Airborne Troops), Air Force and Air Defense Troops that have been brought up to strength, armed and supplied. New missions arise for military aviation in this connection. Considering Russia's present geopolitical situation, how are they to be performed if areas of operational employment of the Mobile Forces may be in Europe, the Near East or East Asia? How is the movement of aviation over such considerable distances and cover and support of the Mobile Forces in regions insufficiently prepared in the operational sense to be organized? Under such conditions, how is airfield engineer support and logistic support to be provided to air units and formations?

There seem to be more questions here than answers. The range of views and opinions is diverse. Certain opinions on these problems are expressed in this article.

In organizing air support of the Mobile Forces, one should proceed above all from the fact that, first of all, they are air-transportable and, secondly, they have everything necessary for conducting independent combat operations. Therefore aviation forces used in their support also must possess high mobility, which is understood to mean not only the capability of air units and formations to displace rapidly, but also their constant readiness to perform combat missions in any regions, including for lengthy autonomous operations in isolation from permanent stations and under diverse physical-geographic and climatic conditions.

Further it is necessary to take into account the specific nature of missions performed by the Mobile Forces, such as increasing stability and building up combat might of troops on threatened axes; covering their deployment and forward movement; holding important lines and closing breaches when the defense has been penetrated; and conducting combat operations in the enemy rear. They differ substantially in substance from missions performed by other force elements. Thus, while operational air assault forces are dropped into the enemy rear figuring to link up in 2-4 days with the main body operating from the front, the Mobile Forces will conduct more lengthy raiding operations.

Finally, the nature and conditions of employment of the Mobile Forces must be taken into account. Their employment may begin with the threat of aggression, and then air units and formations will be able to execute an anticipatory maneuver and prepare for combat operations. It will be much more difficult to enter battle immediately after arriving in an unfamiliar, remote area, such as when the Mobile Forces are used to close breaches in the defense.

These and other features of the Mobile Forces and their flexibility and diversity of employment show that "classic" aviation missions of covering and supporting troops and air assault forces on the ground and in the air cannot be transferred here mechanically, just as it is also impossible to organize its combat operations according to a rigid, optionless principle. This stems at least from the very purpose, nature and conditions of employment of the Mobile Forces, which was mentioned earlier. But how is one to seek out, develop and optimize a certain set of options if missions of military aviation in themselves contain a number of unresolved issues? We will single out some of them as an example and will dwell only on the main problems of their execution without going into the content of these missions.

There is the **movement of the Mobile Forces and combat aviation to intended areas of operation.** Performance of the first part of this mission is assigned to Military Transport Aviation, which is most suitable and convenient for urgent, large-scale movements of major troop contingents over considerable distances. The high efficiency of air transport movements and large cargo capacity of military transport aircraft permit creating an "air bridge" by which the most mobile, combat-ready units initially are moved and then the others, and subsequently the influx of reserves and supply of the Mobile Forces are supported.

But not everything is as smooth here as one would like. The capabilities of Military Transport Aviation are not that great. According to specialists' estimates, movement of the Mobile Forces within prescribed time periods requires at least 180-190 Il-76 aircraft. Therefore replenishment of the Military Transport Aviation air fleet and acceleration both of its "turnover" as well as of the movement process itself remain a very important problem. The experience of Military Transport Aviation's work in Chechnya confirms this.

Other problems are generated by the redeployment of combat aviation itself to the intended area of operation.

For example, the intertheater maneuver of aviation from European Russia to the Far East was rehearsed during the Air Force Voskhod-93 experimental tactical air exercise. Having made a "leap" over a distance of around 8,000 km with three aerial refuelings and one intermediate landing for crew change, ten Su-24M and Su-24MR front bombers delivered a strike against targets on a Priamurye range. Four Su-27 fighters as well as six Tu-95MS bombers arrived in the intended area of operation in less than 24 hours. Eight MiG-31 air defense aviation aircraft operated over a distance of 4,000 km in executing an interregional maneuver from western oblasts to Siberia.

The exercise showed the real capability for moving aircraft over great distances, but problems remain: How is such a maneuver to be executed when not tens, but hundreds of combat aircraft of the air grouping being established will be taking part in it?

The following question also arises: How are aerial tankers and aircraft being refueled to be protected if the refueling areas end up within reach of enemy tactical fighters, for which the mass takeoff of our aircraft hardly will go unnoticed? To an even greater degree this concerns covering the military transport aircraft, which are distinguished by relatively slow speeds and maneuverability and which follow routes in columns of great length.

Evidently the key to solving these problems must be sought in improving the training and proficiency of flight personnel and organizing stable command and control of large aviation forces not only from the ground, but also in the air. For example, airborne command posts of the CINC Air Force and commander of Long-Range Aviation and the A-50 airborne early warning and control complex were used in that same Voskhod-93 exercise. And it is desirable to begin a maneuver with fighter aviation units, and not only provide cover for the rest of the forces, but also create favorable preconditions for winning air supremacy in the intended area of operation.

By the way, **the mission of winning air supremacy and covering the Mobile Forces grouping** has to be examined in light of overall enemy superiority, inasmuch as the numerical strength of our aviation has been reduced appreciably. The critical nature of the situation does not even stem from this negative fact. Something else is more alarming. The qualitative growth of military aviation also has slowed, but the potential enemy has fundamentally new means which he previously did not have (low-signature aircraft, long-range precision missiles, and new-generation drones) and capabilities for EW suppression of command and control systems.

In my view, a depressing picture is forming. Therefore, whether we like it or not, even with observance of the principle of massed, centralized deployment of aviation in support of the Mobile Forces, especially during their operations in isolation from the main troop groupings, it will have to struggle basically for tactical air supremacy—temporary supremacy and in a limited area. And covering the Mobile Forces operating in springboards or in the enemy rear will be complicated on the one hand by lesser capabilities for coordinating with ground air defense weapons, by their weak protection and by low operational density of troops and stretched lines of communication, and on the other hand by enemy operations from any directions and by our aviation's unstable, fragile air supremacy.

Just what kind of solution is seen to such a complicated situation? Massive albeit brief employment of aviation against enemy air elements most dangerous for our troops must be made the basis of operations by fighter aviation, and the engagement of a limited number of priority targets (aircraft at airfields, command and control facilities, radar complexes) must be made the basis of operations by strike aviation. Surprise, stratagem and disinformation—in short everything that would allow seizing the initiative in the air—can play more than the least role here.

Such is reality. Of course, the operational and strategic air supremacy which formed, for example, in the concluding stage of the Great Patriotic War is enormously more preferable, but this is the case where a bird in the hand is worth two in the bush.

Now about **air support of the Mobile Forces.** Strike aviation encounters two problems in performing this mission. The first is that it is difficult to make out the location of opposing sides. Consequently, there is a great danger of delivering strikes against friendly troops, who most often will be operating under conditions of a "nonlinear" battlefield, where there is no clear-cut front line, but on the other hand mutual penetration, exposed flanks, "centers" of skirmishes and so on are likely. For example, in the course of the Chechen conflict federal troops were opposed by various irregular force elements which, employing guerilla warfare tactics, often "dissolved" among the local population. The same types of equipment and arms basically were used on both sides, and so it was no simple matter to identify their affiliation. In such a dynamic, vague situation it is especially difficult to detect and engage small but important targets. And here one cannot get by without aerial reconnaissance, which must conduct constant surveillance of the opposing side's actions.

The second problem stems from the first—in a rapidly changing battlefield situation that is difficult to predict it is impossible to count on sufficient data on the development of events according to a previously outlined plan and also on concentrating the necessary quantity of forces and weapons. For these reasons the traditional approach to planning air support, acceptable in preparing "classic" operations, far from always will conform to conditions of employment of the Mobile Forces, let alone with low validity of data on the location of targets. In opposition to a stronger enemy it is evidently

more apropos to rely on delivering selective air strikes, as was the case in that same Chechnya.

Summing up what has been said, we will note that many gaps still remain in the missions of aviation operating in support of the Mobile Forces. These missions were intentionally viewed as applied to the most unfavorable conditions of troop operations. Life itself forces us to look at them specifically that way and not otherwise, and already now to outline ways of solving the problems coming to a head.

Among the latter is command and control of aviation in areas insufficiently prepared in the operational sense. Of course, one can and must form operations groups on high air staffs in advance made up of representatives of the principal directorates and services and oriented toward work in support of the Mobile Forces. But how are air units and formations to be controlled if there are no previously prepared command posts meeting modern requirements where they will be operating?

Today mobile ground and airborne command posts are considered the basis for creating a command and control system under such conditions. This idea has been up in the clouds for a long time, but possibilities of realizing it generate no great optimism for now, above all because such a system will be able only to supplement, not replace a stationary system. Further, it will not possess sufficient survivability under conditions of Mobile Forces employment. In addition, realization of this idea largely depends on the state of affairs in the country's economy. But perhaps the crux of the problem lies in quite a different plane: Why not take the Mobile Forces command and control system as a basis, interfacing our ground and airborne command posts with it?

Alas, aviation's troubles do not end here. In areas with a weakly developed infrastructure there also may not be a sufficient number of equipped airfields adapted for landing the Mobile Forces and basing combat aircraft. One way of solving this problem is to register airfields and distribute them among air units and formations. Another way is to assess the capabilities of other departments' airfields. If the airfield network still turns out to be insufficiently capacious, then it will be necessary to expand the size of Mobile Forces landing areas.

Further, Aviation Engineering Service specialists must have ground equipment and sets of spare parts for doing independent work as they accompany units which execute a maneuver and for servicing them at destinations.

Aviation rear services also will be faced by no less difficult problems. In order not to increase the time periods for maneuver of our aviation and not force it to operate in small elements, it is not enough to improve the logistic support system at various levels; it is also necessary to establish a rigid priority in receiving and distributing supplies, especially aviation fuel, and to form capable mobile entities for command and control of rear services.

As we see, there are more than enough tasks and problems for military aviation operating in support of the Mobile Forces. How can they be solved? It would appear that it is altogether insufficient to hold special classes with aviators to study the Mobile Forces makeup and missions. It is necessary to develop in pilots and navigators firm skills of actions in support of the Mobile Forces, including by all squadron, unit and formation personnel.

There is no question that the training of flight and engineer-technical personnel for performing such tasks will become more specific if it is preceded by a search for and development of optimum options for the operation of aviation on each operational axis. There should be as many optimum options as there are axes. These options can be compiled for operations of aviation in armed conflicts and for performing other missions. Then on the basis of these options it is advisable to develop corresponding scenarios according to which it is convenient to conduct training drills for staffs and personnel as well as joint exercises with the Mobile Forces.

And the last thing. As is our custom, although a decision has been made on some important question in military organizational development, its implementation begins with great delay. To keep such a thing from happening this time as well, already today it is necessary to activate the training of air units and formations for operations in support of the Mobile Forces. The conflict in Chechnya is weighty confirmation of this.

From the editors. *In upcoming journal issues we will continue the discussion of problems raised in the article by Colonel (Retired) Krasnov. We invite representatives of the Air Force Main Commissariat and of the Ground Troops Aviation command element, other interested parties and aviators at the tactical level to take part in it.*

Russian Geopolitics and Security

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[Article by Colonel Valeriy Cheban, doctor of philosophical sciences, academician of Academy of Military Sciences, under rubric "Military-Political Review"]

[FBIS Translated Text] *What is the essence of features of Russia's entry into the structure of contemporary interstate relations? What place does it hold in the world today? What are the military-political problems of ensuring its security and the ways of resolving them?*

*This is the subject of the article by Colonel **Valeriy CHEBAN**, doctor of philosophical sciences, academician of Academy of Military Sciences.*

Substantial changes occurred in the military-political situation as a whole after the USSR disintegrated and the "cold war" ended. This could not help but reflect on Russia's geopolitical[1] situation and on its role and place

in the world system. In painting a picture of the post-Soviet world, western politicians and political scientists paint it as unipolar, assigning the predominant role to the United States. Russia is included among secondary countries.

This is logical at first glance. Russia is significantly less than the Union in territory and in size of population and was deprived of allies and traditional markets. But today such a superficial approach is insufficient for defining Russia's position in the new forming system of military-political coordinates. Russia has a special geopolitical and geostrategic position. It is present in Europe and Asia simultaneously. What capabilities our state has for full-fledged participation in European and Asiatic affairs at the given moment is another question.

Today the contradiction has exacerbated considerably between Russia's expanse and unique geostrategic position and its actual capabilities not only for conducting active geopolitics, but also for preserving the inheritance it received after the "fall of the Empire." We are entering a complex, multilevel system of contemporary interstate relations with economic, scientific-technical and military potentials undermined (the result of social experiments). The concern over preserving the legacy in the area of interstate relations also is dictated by the circumstance that Russia is entering a system of market relations where the fiercest competition predominates.

The traditional interest in Russia and in its place in the world has been filled with new content today. Let us recall the prophetic words of D. Mendeleyev that Russia "represents both the end and the means for the economy of many countries. It will generate even greater interest when many people actually encounter results of their material activity and problems of living space."

Such problems already have arisen, as indicated by contradictions between growing needs of western countries for raw materials and their actual reserves, and between the population growth and poverty of third world countries. Many states today are ready to carry out so-called "ethnic dumping" on neighbors to avoid a demographic catastrophe. For example, each year our Primorye borders alone are crossed by around 200,000 Chinese. The immigrants start families, buy houses and take part in the region's commercial life.

Russia's space and natural resources also represent an enormous temptation for developed world states. Thus, the United States released a "trial balloon" concerning the creation of seven new states on the territory of Eastern Siberia. The idea of "Americanizing" territory along the Yenisey west of Irkutsk to Mongolia is being advanced. Lake Baykal, which has concentrated over ten percent of the world reserves of fresh water, also is seen under the Stars and Stripes. In the opinion of U.S. political scientists, all this will permit simultaneously solving the problem of social tension in this region and lowering China's possible military-political activeness.

The general instability caused by the downfall of a bipolar world structure (USSR-USA) and establishment of a multipolar world structure also substantially influences Russia's role and place in the system of contemporary military-political relations. Various states are creating new "force fields" and are becoming centers of attraction for other countries and peoples. All this objectively stimulates the appearance and rivalry of new leaders on a regional and global level.

For example, the United States is actively using the disintegration of the USSR and Warsaw Pact Organization for asserting its dominant role in the world. Here is a quote from the document "U.S. National Security Strategy": "Never before has America's leading role been so necessary for overcoming new dangers threatening the world and for taking advantage of favorable opportunities in it. America's potential is unique. It is our military might, our dynamically developing economy, our great ideals and, most important, our people. We can and must exert an influence on world processes by our involvement, but the degree of our involvement in them should be regulated carefully so that it meets our interests and priorities."

The intensifying rivalry among the North American, Western European and Asiatic-Pacific regions for strengthening their influence on former Soviet Union space also is a reality. The United States is such a "power center" on the American continent. In Western Europe it is formed by Great Britain, Germany and France, and in the South by Turkey and Iran, which in the summer of 1994 agreed to act against "Russian intervention in the Transcaucasus" and to support Muslims in the former Yugoslavia. In the East the force fields are formed by China, Japan and South Korea. All are striving to draw former socialist countries into the orbit of their national interests.

The enumerated circumstances are linked directly with the countries' military policy. Therefore, concerned with ensuring its own security, Russia has to take into account that the arms race still has not been stopped despite radical positive changes in the world, and leading world countries are giving priority to military might. The aforementioned "U.S. National Security Strategy" emphasizes: "Today the presence of powerful Armed Forces in readiness to conduct combat operations is required above all in the interests of strengthening national security."

The United States not only is concerned with maintaining its military might, but also came out as the initiator of a further strengthening and expansion of NATO. At a meeting of heads of state and governments of member countries of the Conference on Security and Cooperation in Europe held in Budapest in early December 1994, U.S. President Bill Clinton stood up for most rapid entry of Poland, Hungary, Czechia and Slovakia into the North Atlantic bloc. This will bring

NATO closer to Russian borders and, instead of establishing European unity, will lead to the creation of new demarcation zones.

Consequently, Russia must resolve a number of problems of a military-political nature in ensuring its own security, and above all determine the role and place of the military-force method in ensuring national security, develop views on the nature of possible wars and armed conflicts, and determine its attitude toward military organizational development of other states and toward partnership in military blocs.

Factors of an internal order—economics, social situation, political processes, degree to which science and culture participate in resolving problems of state importance, and particularly solving problems of military organizational development—also decisively influence the nature of Russia's entry into the structure of new military-political relations. All this requires unremitting attention to problems of military organizational development in our country as a means of the state's military policy and a condition for its protection against armed aggression.

Thus, Russia's successful entry into the system of contemporary relations will depend on our state's capability to adapt its military policy to new geopolitical realities and to the disposition of power centers, on the ability to respond to threats to national security and on the capability for ensuring it with all, including military, means.

Footnotes

1. Geopolitics is one of the fundamental concepts of international relations theory characterizing the place and historically specific forms of influence of territorial-space features of the position of states on local, regional, continental and global international processes.

Development of Russian Military Space Efforts

95UM0324D Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 14-17

[Article by Lieutenant General Stanislav Yermak, chief of staff, Russian Federation Ministry of Defense Military-Space Forces: "The Hour of Cosmonautics Has Struck"]

[FBIS Translated Text] *Russian Armed Forces reform, including structural reform, in our view presumes a comprehensive, objective assessment of the contribution of each branch and combat arm to ensuring the state's security. How do the Military-Space Forces "look" in this regard and what capabilities do they possess? How effective and promising is the employment of space assets in support of the Army and Navy? It would appear that readers will find answers to these and other questions in this article.*

An active process is under way in Russia today, as in other leading world countries, of developing and establishing a new system of views on ensuring national security. Taken into account here are changes in the military-political situation and the level of development of military theory and practice and of means of warfare, particularly space assets, whose role in supporting Armed Forces operations (both in peace as well as wartime) is growing steadily. This is explained on the one hand by the specific nature of outer space. Its exterritoriality and globality permit conducting constant surveillance of all areas of the Earth's surface, water areas, air space and outer space; supporting continuous communications among users (including with submarines) regardless of their location; and using space assets in support of various troop elements (right down to the individual soldier supplied with "pocket"-format communications and navigation gear). It is explained on the other hand by the sharply increased potential of space systems, whose use does not simply increase the effectiveness of operations of troops and naval forces, but in many cases also predetermine success of the mission. The course and outcome of the Persian Gulf war can serve as persuasive proof.

Thus, the U.S. supreme military-political leadership and the multinational forces (MNF) command element used intelligence received from satellites for decisionmaking. It also was taken into account in developing specific combat operations plans, selecting point targets, and guiding individual bombers and cruise missiles to them. Approximately 80 percent of the most important targets were hit specifically in that way. Data coming from IMEWS (the U.S. ballistic missile launch early warning system) spacecraft permitted warning allied troops about an attack by Iraqi operational-tactical missiles and issuing target designations on them to Patriot missile complexes. The effectiveness of intercepting operational-tactical missiles reached 90 percent as a result, and the fact is that such an intercept was being done for the first time under combat conditions.

We also will note the following important point. Without space communications, navigation, and topogeodetic and meteorological support systems the MNF (as well as any other forces) would be unable to orient themselves precisely in the operational situation and on the terrain and coordinate their actions in an unprepared, remote TVD [theater of military operations]. Graphic confirmation of this was the inability of Iraq (which did not have space assets) to restore command and control and organize defense. In the opinion of Henry Cooper, one of the directors of the U.S. SDI program, the war with Iraq became the first one in which space assets played a central role. It is noteworthy that back in the 1960's U.S. President Lyndon Johnson spoke of the possibility of achieving world supremacy as space supremacy was attained.

The importance which various countries attach to development of outer space is difficult to overestimate. We

will note only that the division of space systems into military and nonmilitary is to a considerable degree conditional. Suffice it to recall, for example, the wide-scale use of photographs obtained from French Spot "geological survey" satellites and of civilian space communications channels during Operation Desert Storm.

I am convinced that effective performance of their missions by the Russian Armed Forces is inconceivable today without the development and use of space forces and assets, above all strategic missile attack warning systems, reconnaissance systems, battle management and communications systems, navigational systems and so on. Missions of deterring an aggressor in space and from space, reconnoitering the space situation, providing comprehensive information support to operations of the Mobile Forces and so on may be assigned to the Military-Space Forces in the future.

Modern combat operations presume integrated fire damage of targets with precision weapons, employment of mobile force elements, great depth of active influence on the enemy, a rapid transfer of the efforts of attack groupings, and their presence in considerable isolation from the main body and on territories not prepared in an operational sense. As shown by the experience of field training exercises and military conflicts, traditional means of reconnaissance and other kinds of support turn out to be insufficiently effective under such conditions.

In the assessments of independent experts, during preparation of a first massed fire strike in the course of a front defensive operation, tactical reconnaissance is capable of discovering only around 20 percent of targets subject to destruction. Very important enemy targets remain undetected: reconnaissance-strike complexes, means of nuclear attack, and command and control facilities and centers. In addition, aiming errors can reach 70 percent in preparing artillery and missile systems for use on unprepared territories. As a result, in engaging type targets, ammunition expenditure unjustifiably increases (up to 30 percent), an additional detail of weapons and reconnaissance assets (up to 20 percent) is used, and the time they are present at combat positions also increases.

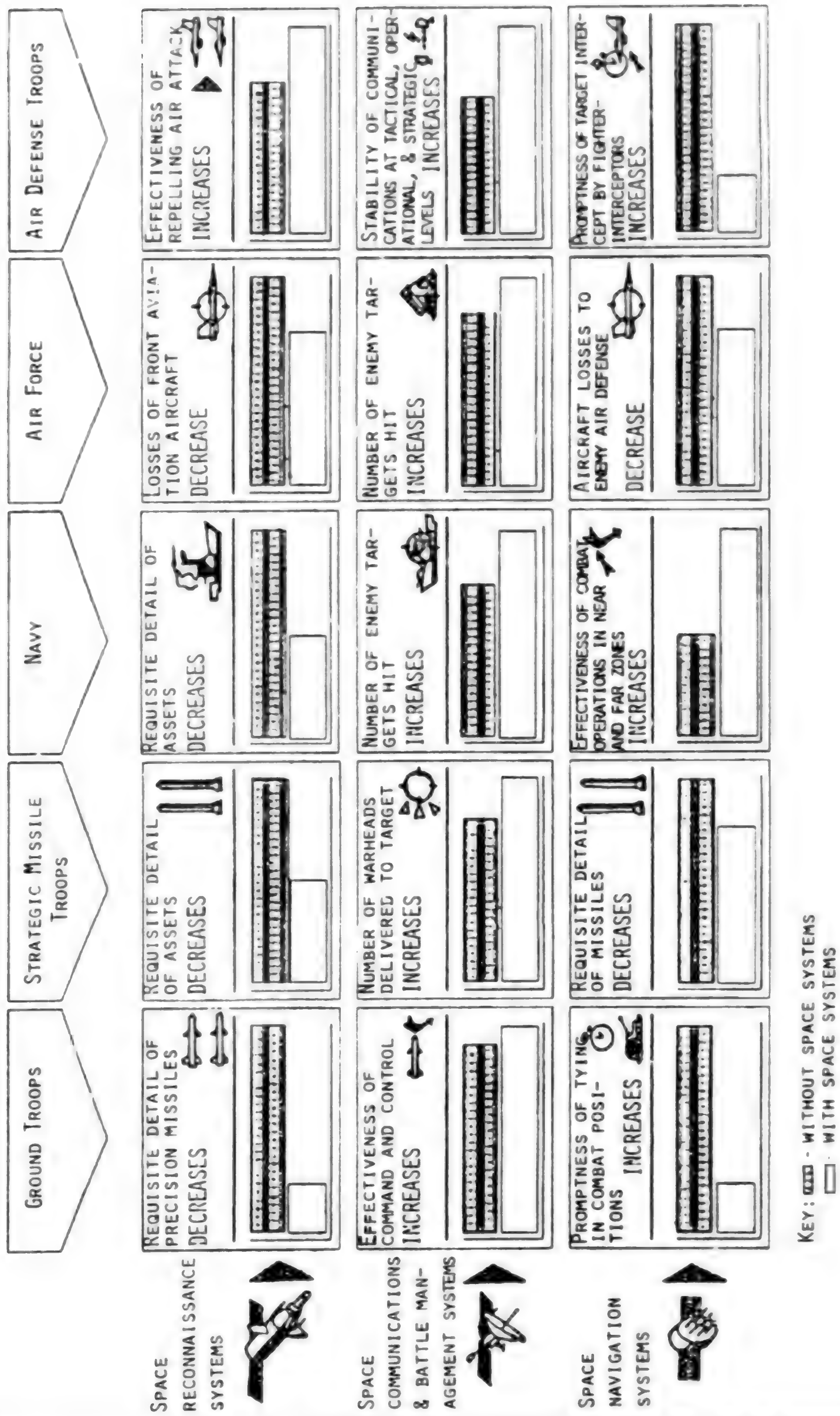
Under conditions of rigid time and other constraints characteristic of operations by mobile forces, conventional communications equipment also does not fully meet requirements placed on it both in promptness of deployment as well as in reliability, antijam protection, traffic capacity, and global nature of coverage. And the advantages of space systems and complexes—promptness, precision, reliability, sufficiency of data and globality—permit them to become the basis for comprehensive support of present armies, and of future armies all the more.

Specifically how is the contribution of space to an increase in Armed Forces combat effectiveness characterized? Above all by a significant decrease in forces and assets for performing combat missions, by increased stability of communications and reliability of command and control, and by other indicators (see diagram). The effectiveness of command and control of strategic nuclear forces can be increased by 60-80 percent (depending on conditions of their employment) through orbital communications complexes. Using space reconnaissance assets it is possible to observe essentially the entire Earth's surface and also to collect approximately 20 percent of intelligence needed by the Navy. The advanced space navigation system is capable not only of enabling users to make a prompt, precision determination of their position, but also of detecting and fixing nuclear bursts and transmitting centralized battle management signals. And how can one obtain hydrometeorological data (on cloud cover, precipitation, condition and temperature of underlying surface, wind velocity and direction) over enemy territory without space systems? An absence of this data sharply degrades the effectiveness of employing the newest artillery, missile and tactical and operational-tactical airborne complexes.

Based on an assessment of the consequences of using space systems for military purposes it also can be asserted that states which have achieved superiority in space also will gain advantages in other spheres of potential opposition. It is obvious that this is what prompts leading world countries to concentrate efforts in applied military space research. Their result may be the creation of a "critical mass" of technologies, which will lead to the appearance of qualitatively new space warfare capabilities.

The conclusion of international treaties and agreements in the military sphere would be extremely problematical without space reconnaissance as a means of national verification of their fulfillment. It is what permits accomplishing wide-scale measures to limit strategic and conventional arms without the danger of unilateral disarmament. Areas of crisis situations and conflicts also are monitored with its help.

Military space also has a great role in strengthening Russia's economic potential. Today almost 85 percent of all installations of the country's space infrastructure are under the jurisdiction of the Military-Space Forces, which exercise control over more than 20 space complexes (around 200 spacecraft), including civilian ones, and over the launch of all booster rockets. Space technologies have been developed which have absorbed the most advanced achievements of domestic science and technology in the area of electric power plants, propulsion systems, data collection, processing and storage equipment, an element base for communications systems, laser and accelerator equipment, structural materials, special coatings, adhesives and so on. As we see, the majority of new technologies developed and mastered in the production of space equipment are of a common nature and can be used both in the national economy as well as in military affairs. And their development has reached that level where the return from space activity will be comparable with outlays for it in just 2-3 years,


Ground Troops
Strategic Missile Troops
Navy
Air Force
Air Defense Troops
Space Reconnaissance Systems
Requisite detail of precision missiles decreases
Requisite detail of assets decreases
Requisite detail of assets decreases
Losses of front aviation aircraft decrease
Effectiveness of repelling air attack increases
Space Communications & Battle Management Systems
Effectiveness of command and control increases
Number of warheads delivered to target increases
Number of enemy targets hit increases
Number of enemy targets hit increases
Stability of communications at tactical, operational, & strategic levels increases
Space Navigation Systems
Promptness of tying in combat positions increases
Requisite detail of missiles decreases
Effectiveness of combat operations in near and far zones increases
Aircraft losses to enemy air defense decrease
Promptness of target intercept by fighter-interceptors increases
Key: - without space systems
- with space systems

and the profit will be around 25 percent of invested funds by the end of the present decade.

These are persuasive arguments in the controversy about how effective and promising the use of space systems and technologies is in the interests of strengthening the state's defense and economic might. Not taking them into account in choosing the most rational directions for development and employment of the Military-Space Forces and in determining their role and place in the new structure of the Russian Armed Forces means dooming ourselves to inevitable backwardness. There are possible options here. For example, leave the Military-Space Forces as an independent component of this structure, which will permit preserving the country's military-space potential and even building it up without substantial material outlays and losses for performing other defense missions. Another option is to consolidate the Military Space Forces with one of the prospective branches of the Armed Forces, but it does not appear to be as good from the standpoint of logic and prospects for development of military affairs. Let us recall that there was a time when the state's authority and its influence in the world largely were determined by the might of the Navy, later came the age of aviation, and now I am sure the hour of space has struck.

Logistic Support in Chechen Conflict

95UM0324E Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 24-25

[Article by Colonel Vladimir Timoshenkov: "The Soldier Received What Was Authorized: Analysis of Work of Rear Services Subunits in the Chechen Conflict"]

[FBIS Translated Text] As the armed conflict in Chechnya flared up, the wall of anti-Army criticism which many of the mass media built from the very beginning became ever higher and more powerful. Its goal was to discredit the Army. Generals can be replaced, the President can be reelected, but the stigma on the Russian Army will remain for a long time.

It has become very fashionable of late to severely criticize and lecture the Armed Forces behind the soldier's back. Problems of logistic support of troops and the settling-in of soldiers are savored with special partiality. "The soldier receives a hot meal for the first time only in captivity," "He still has not once seen a clove of garlic or an onion. And this in our time! And this in our Army!" and so on (PRAVDA, 24 December 1994, interview of S. Kovalev for the Russian Television program "Details" of 5 January 1995, and the essentially daily attacks of MOSKOVSKIY KOMSOMOLETS).

No one is arguing that logistic support of fighting units and subunits always was faultless. Commanders and rear services specialists possibly did not do the work somewhere. It possibly happened where servicemen could not receive a hot meal under extreme conditions of a combat situation or received frostbite, but these are exceptional cases and it is of course impossible to draw a general conclusion about the extremely unsuccessful work of rear services based on them.

An analysis of logistic support of troops in Chechnya for each kind of support will clear up the situation. There were 112 supply points deployed in the conflict area and soldiers were supplied with bread, water and 20 cigarettes per person per day without interruption.

Daily reports from the sites of events attested that there were no disruptions in food supply. All personnel, including officers and warrant officers, received the basic standard ration established by Minister of Defense Order No 200 of 1992 and the supplementary ration in accordance with Russian Federation Ministry of Defense Order No 412 of 8 December 1994. The following was issued per person per day: meat 300 grams, butter 50 grams, sugar 100 grams, biscuits 50 grams, tea 2.2 grams, cow's milk (or juices) 350 grams, cheese 30 grams, hen's eggs 6 per week, and other food products.

In addition, 100 tonnes of sugar, 10 tonnes of condensed milk, 10 tonnes of cheese, 25 tonnes of semicured sausage, 2 tonnes of salted pork fat, 500 kg of chocolate, 20 tonnes of butter, 30 tonnes of biscuits, 500 kg of tea and 250 kg of coffee were procured along the line of humanitarian assistance.

Servicemen operating in isolation from the main subunits to whom it was impossible to issue hot meals were provided with dry rations figuring one packet per person per day. The ration consisted of 300 grams of hardtack, 350 grams of canned meat, 500 grams of canned meat and vegetables, 120 grams of Dorozhnyy refined sugar and 4 grams of tea.

Five tonnes of dry fuel were supplied to the troops for heating canned meat and canned meat and vegetables and for preparing tea. Over 8 tonnes of garlic were additionally procured and delivered for preventing flu and improving the flavor qualities of food; this supplied the need for the daily issue of garlic.

Despite assertions of some of the mass media, personnel of Russian Federation Ministry of Defense units and subunits also were supplied with sufficient quantities of clothing and related gear. Servicemen arrived in the conflict area in winter field uniform (cap, summer suit, winter suit, boots, underwear, warm underwear, two pairs of foot cloths, one pair of mittens). Sleeping bags, felt boots, rubber boots, wool helmet liners, body armor, mess tins, canteens, four sets of underwear, and white camouflage suits were issued in addition to this. A reserve of mittens, soap and underwear was established in each subunit.

More than 1,500 tents were set up to accommodate and warm personnel. True, servicemen in trenches at forward positions did not always have an opportunity to use them because of the constant fire of Dudayev's fighters.

Before moving up to combat operations areas and after being withdrawn from forward positions, the people had an opportunity to wash themselves and their underwear in mobile field baths, in the bath and laundry train, and in laundries.

More than 200 motor transport vehicles of the North Caucasus Military District and of units of central subordination delivered supplies to the troops daily from depots and bases of the district and from the city of Mozdok. The Russian Federation Government approved a special schedule for delivering fuel to troops operating in Chechnya. In accordance with this schedule, tens of thousands of tonnes of fuel were delivered to the North Caucasus region, which on the whole permitted ensuring fulfillment of missions assigned to the troops. A field bulk distribution pipeline was set up. Fuel service personnel worked under most difficult conditions in supporting combat operations of subunits and the day-to-day activity of troops with a large assortment of fuels and lubricants.

Veterinary support for zones of responsibility was accomplished by personnel and equipment of authorized veterinary establishments and formation specialists. There were 1,102 tonnes of food subjected to veterinary-medical examination. All food products were of high quality and of recent time periods of manufacture. No instances of food poisoning of personnel were noted and a stable medical-epizootic situation was maintained.

Exchange service for the military contingent in the conflict zone was provided through trade departments in Vladikavkaz and Volgograd and the military exchanges of Mozdok, Makhachkala and Maykop. Exchange service was organized in the Mozdok garrison through a fixed network, including three mixed stores, three public catering enterprises and three mobile exchanges. The assortment of food commodities of the Mozdok military exchange included sugar, groats, flour, animal and vegetable oil, canned meat, milk and vegetables, powdered milk, children's food, tobacco items, confectioneries, salt, tea, coffee, cheese, eggs and other food products.

Ten mobile exchanges served military units under field conditions. The assignment of the necessary number of mobile exchanges for military units newly arrived in their deployment areas was envisaged.

I wish to remind those who are dissatisfied with the rates and quality of performance of missions of supporting the troops that, like all personnel of the troop grouping, rear services specialists were not operating under peaceful conditions, and "Army granaries" have emptied noticeably in recent years. Our state is keeping its Army in poverty. Nevertheless, the rear services performed their missions. Our soldier in Chechnya was full and had warm clothing and footwear. Those who worked on this there know what efforts it cost to achieve this. I am speaking not for the sake of reproaching the aroused politicians and journalists, especially as many of them are working in Chechnya even today in performing their professional duty, I am simply showing the situation as it was in fact.

'Roving' Company Strongpoints, Battalion Defense Areas Proposed

95UM0324F Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 26-28

[Article by Colonel Nikolay Utkin, candidate of military sciences, under rubric "What's New in Combat Tactics": "'Roving' Strongpoints"]

[FBIS Translated Text] The improvement of equipment and arms, the integration of means of reconnaissance and weapons, and the increased role of the sides' fire effect in battle seriously exacerbated the problem of preserving personnel and equipment in defending a first position. The modern enemy is capable of engaging subunits and units defending in the first echelon essentially from any directions and altitudes, under any weather conditions, with diverse personnel and equipment, which was proven once again in that same Afghanistan and in other local conflicts in which, alas, our time so abounds. And we know from Great Patriotic War experience that even with that level of technical outfitting of reconnaissance, the Germans discovered targets located on and immediately behind the FEBA [Forward Edge of the Battle Area] considerably easier and faster than troops located in the depth. But now there is every opportunity to uncover the defense to the depth of the first position essentially down to each weapon. And inasmuch as an assault on the first position always will be preceded by fire preparation with precision weapons and fuel-air explosives and by air strikes, the bulk of enemy fire will fall to the lot specifically of these targets.

Is it necessary to prove that a breakthrough of the first position (especially with a position defense) will permit attackers who have wedged in on individual axes to exploit success into the depth, create favorable conditions for landing a tactical airborne assault force and even seriously disrupt stability of the defense from regiment on up?

Based on these considerations, which, by the way, are shared by many contemporary western military specialists, we must seek new ways of preserving personnel and equipment and carefully concealing the FEBA and the defense alignment. And in my view, there are two fully acceptable and effective methods here as a minimum.

The first method is not new and is simple to understand, organize and carry out. It consists of more powerful second echelons being formed in the defending formations and units and timely restoration of the first position at their expense. Naturally, this will require accurate calculation of personnel and equipment, well adjusted command and control, consideration of terrain features,

and thorough preparation and support to forward movement and occupation of the defense sector (area) in place of units (subunits) which have lost combat effectiveness.

In implementing the aforementioned method it is very important to preempt the enemy in moving second echelons (reserves) up to the line of the first position, which sometimes may prove very problematical. Moreover, in accordance with the present follow-on forces attack concept, on the basis of which the operating tactics of armies of a number of countries of the far abroad basically are being developed, subunits earmarked for restoring combat effectiveness as a rule are pinned down by fire, by air and precision weapon strikes, by remote minelaying or by tactical airborne assault forces. Therefore breaches should be closed in extremely compressed time periods. In case of some delay, it is advisable to complete the forward movement of second echelons (reserves) by occupying switch positions, which also will give a certain result.

The second method appears more preferable to me inasmuch as it is based on high maneuverability, firepower, decisiveness and activeness of subunits. Its main distinguishing feature is the establishment of "roving" company strongpoints and battalion defense areas. They will permit concealing the true trace of the forward edge and of battalion areas (company strongpoints) at the first position and also preserving stiffness and stability of the defense. This method is most effective in the initial phase of war, which is characterized by advance preparation of all kinds of defense, but it also can be used successfully under other situation conditions.

Speaking of the essence of this method, it consists of advance establishment of several defense areas within the first position for battalions defending that position. Then follows a displacement of personnel and equipment to these areas within the position, planned according to time or executed in response to signals. Figuratively speaking, by displacing its company strongpoints, the defense area constantly or periodically "roves" within limits of the first position. As a result it will be rather difficult and sometimes even impossible for the enemy to determine the disposition of weapons and subunits. But even if the enemy does discover the "roving" areas, he will be forced to plan and execute the delivery of fire against all company strongpoints discovered (created in advance). Ammunition expenditure for engagement will increase here depending on their number.

It may seem to some that the defense option being considered will require a considerable expansion in the scope of engineer work. This is not so. Engineer work will take 7-9 days in preparing company strongpoints, counting preparation of alternate and dummy areas, switch positions and lines of fire positions. Positions usually are prepared in this period of time.

Meanwhile, the "roving" of the forward edge and the displacement of company strongpoints with established periodicity will not affect selection of the axis of concentration of main efforts and staunchness of holding an area on which stability of the defense depends. Companies execute a maneuver and occupy the most favorable position immediately after completion of fire preparation of the assault and sometimes even under its cover (when an enemy who has been deceived brings fire on dummy targets).

Of course, using "roving" areas (strongpoints) will require more precise organization of the system of fire. A need also will arise for displacing command-observation posts of battalions, the regimental observation post, air defense weapons and, in certain instances, artillery and other elements of the battle formation. This is a positive factor and on the whole reduces the likelihood of their detection and engagement, but on the other hand such a maneuver will require well adjusted coordination, command and control and all kinds of support.

The suggested option for aligning the defense at the first position permits preserving the width of the defensive area necessary for ensuring sufficient weapon densities. Its depth will change slightly and can be 10-12 km. The depth of the first position is a constant value; it "floats," as it were, depending on the position of the companies and is within the limits of from 2.5-3 to 4-6 km.

Additional outlays of technical equipment for providing communications and a search for more advanced ways of technical and logistic supply will be required in addition to new approaches to organizing command and control. The POL expenditure also will increase and questions of protection against precision weapons will become more complicated.

Nevertheless, in my view the advantages of the second method are obvious. First of all, it is a question of preserving personnel and equipment assigned to conduct combat operations at the first position, not replacing them by second echelons (reserves). Secondly, the enemy is forced to expend a minimum of four times more ammunition to achieve the requisite degree of damage of first echelons. Thirdly, by excluding the employment of second echelons (reserves) for restoring combat effectiveness, capabilities of using them for performing other missions increase. Fourthly, the aggressiveness of the defense increases on the whole.

But a similar alignment of the defense at the second position may have a negative effect on its stability, since command and control and support will become more complicated and the amount of engineer work will increase. Oversaturation of the defense with various fortifications always hampers maneuver. In addition, the depth of the defensive area will change (to 15 km) and there will be a reduced overall area for artillery and air defense positions and for disposition areas of mobile obstacle detachments and antitank reserves.

In conclusion I wish to say that theoretical propositions based on practical examples from the history of development of tactics were the basis of this article. I dare say

that further examination and official approval in experimental and tactical exercises of the two methods of defending the first position which I have proposed will assist commanders at all levels to increase their tactical proficiency.

Calculating Force Ratios

95UM0324G Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 29-30

[Article by Nikolay Shishkin, doctor of military sciences, professor: "Numerical Ratio: A Comprehensive Approach To Calculating Superiority in Personnel and Equipment"]

[FBIS Translated Text] *In past times on the eve of battle every military leader would compare his own and enemy forces, which provided an opportunity to anticipate its outcome. At that time success in battle basically depended on the number of cavalry and infantry and the endurance of soldiers. The situation changed as means and methods of warfare developed, but military leaders continue to be troubled by the question: How can victory be calculated?*

Thus, superiority in personnel and equipment often is understood to mean a quantitative indicator. In this case the amount of superiority usually is expressed by the ratio of personnel and equipment (for example, 2:1 in tanks, 3.5:1 in artillery, 1:1.5 in antitank weapons and so on).

At the same time, we will take into account that enemies usually have different kinds of weapons and combat equipment. Let us assume that side "A" has certain types of tanks, antitank weapons and guns and side "B" has other kinds. In this case the simple arithmetic number of these weapons correlated with one another in the proportion, for example, of 2:1 in tanks and 1:1.5 in antitank weapons will not reflect the true ratio that accurately.

In recent years the troops have begun using the qualitative combat effectiveness factor of means of warfare for calculations. As a result, the ratio we accepted in tanks and antitank weapons now no longer is 2:1 in tanks, but 1.5:1, and not 1:1.5 in antitank weapons, but 1:2. It is obvious that a different operating method will have to be chosen. It is especially important to consider qualitative characteristics in the presence of different types of weapons and combat equipment. At the same time, even in this case an existing numerical superiority in personnel and equipment does not reflect true force ratios. Let us assume that it turned out to be 2:1 in tanks, 1:1.5 in antitank weapons, 3.5:1 in guns and mortars, 1:2 in air defense weapons and 1:1 in infantry (in terms of battalions) in favor of side "A". How can that ratio be evaluated? In whose favor is it and by how much? At first glance, the superiority of side "A" (except for antitank weapons) is obvious, but it still is not enough for attacking an enemy who has occupied a prepared defensive line, inasmuch as infantry is the deciding force in breaking through a deliberate defense saturated with antitank weapons.

In this connection, to evaluate the sides' comparative strength, people resort to calculating combat potentials of force elements and their combat assets. The combat effectiveness of some quite specific combat assets—tanks, guns, or antitank weapons—is taken as unity and all other combat assets are correlated with it to obtain a particular value for the factor of commensurability with the "standard." Of course, this is not an identity correlation, but a conditional one. Nevertheless, it permits determining the proportionality of combat might of groupings in approximately the same key.

Thus, force groupings whose ratios of the amount of combat assets are given above may receive one general indicator of combat potential (CP_{gen}) instead of several different indicators with consideration of their combat effectiveness factors (K_{cc}). It is obtained by adding the products of the amount of combat assets and their factors:

$$CP_{gen}=N_iK_{cei}+M_jK_{cej}+\ldots+L_qK_{ceq},$$

where N_i, M_j, L_q are the amount of particular combat assets,

K_{cei}, K_{cej}, K_{ceq} are indicators (factors) of their combat effectiveness.

Of course, such formulas are unacceptable in exercises, and especially in a combat situation, but it is possible to determine the combat potentials of essentially any typical troop force elements in advance on their basis.

In the result, one side's quantitative superiority over the other in terms of combat potential indicators may receive a simple expression, such as around 2:1 in favor of side "A," which will permit deciding the question of the amount of superiority in a rather substantiated manner and finding the optimum method of actions. Still, even an identical value of combat potential indicators does not always characterize comparable equality of combat capabilities. Therefore in determining one side's superiority over another it is very important to consider the proportion of particular kinds of weapons in their combat potential and their priority in performing a combat mission in a specific kind of battle. In this connection, in a number of cases it will be necessary to compare not only identical kinds of weapons, but also those capable of opposing each other.

Creation of superiority is a dialectical phenomenon. The attackers should understand it as taking the numerical strength of personnel and equipment to a level sufficient for achieving victory over the defenders. Overall superiority should be around 2:1, but on the axis of main attack it should be taken to 5-6:1. But the concept of "superiority" has a specific meaning for defenders only in the sense of sufficiency of personnel and equipment for reliable (guaranteed) repulse of the attackers' blow. It is enough for them to have around 30-50 percent of personnel and equipment with respect to the attackers, and sometimes even less for brief defensive actions.

It appears that the ratio of the sides' personnel and equipment at a level of combat potentials around 2-3:1 theoretically guarantees them equal capabilities—for one to attack and for the other to defend. With that ratio (or close to it), an equilibrium of personnel and equipment arises as it were, dictated by the fact that as a rule the defender becomes approximately two or three times stronger while having just as many times less personnel and equipment. Essentially this signifies that to create a superiority each side must undertake special measures to build up personnel and equipment: the attacker to bring it to 5-6:1 on the decisive axis and the defender to concentrate the number of personnel and equipment which would bring this superiority from 5-6:1 down to 3:1 as a minimum.

Under present conditions this problem cannot be solved only by concentrating the requisite number of personnel and equipment at the decisive place and by a certain time. In addition to this it also will be necessary to weaken (destroy) part of the other side's personnel and equipment by making effective use of fire and by neutralizing elements of the enemy command and control system. At the same time it is necessary to reliably protect one's own command and control assets, use preemptive actions in deployment, in commencing fire and in maneuvering, and ensure concealment and surprise of actions being carried out.

Each of these actions (phenomena) separately gives a particular side quite definite advantages. But a sufficient qualitative superiority is possible only in the aggregate, including sometimes also without a substantial increase in the number of personnel and equipment, especially as it is becoming more and more difficult to concentrate significant forces in a relatively limited area because of the threat of overcompaction and increased danger of their engagement by precision weapons. In this connection fire damage in the offensive acquires special importance in creating the necessary superiority.

In addition, the level of command and control and fire control lately has begun to influence the creation of superiority. Thus, just through disruption of the command and control system, troops are deprived of the capability of making effective use of weapons, partially losing combat effectiveness in so doing. Therefore if one side manages to disrupt the other's command and control system, this will give it a significant increase in combat potential.

Effectiveness of troop protection is no less important a factor in achieving superiority. The survivability of subunits increases by two or three times at positions that are well prepared in the engineer sense. The role of preemption and surprise in achieving superiority also should be stressed especially.

Thus, it is possible to achieve superiority over the enemy not only by the number of personnel and equipment, but also by taking advantage of a large number of other factors. It is natural that each of them affects the creation of superiority unequally. Therefore only a creative approach to evaluating their effect in a situation that is specifically taking shape can permit using them effectively and because of this achieving maximum results with the minimum sufficient number of personnel and equipment.

FROM THE EDITORS

The question of calculating superiority of personnel and equipment in combat operations of course cannot be exhausted in one article. We await suggestions from readers on the methodology for calculating combat potentials of personnel and equipment and the effectiveness of weapon systems in different situations and kinds of battle. It would be interesting to learn what the professionals think on this score.

NBC Defense of Regiment, Battalion

95UM0324H Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 33-37

[Article by Lieutenant General Boris Ivanov, candidate of military sciences, and Colonel Valeriy Goldobin, candidate of military sciences, docent: "NBC Defense in Battle"]

[FBIS Translated Text] *With this training year units and subunits began mastering a new kind of combat support—NBC defense. And while regulation documents are being revised, we asked leading specialists from the Military Chemical Defense Academy to express their views on this score.*

The requirement for NBC defense is determined both by the employment of mass destruction weapons in battle as well as by the manifestation of the very same casualty-producing elements as a result of the destruction of installations with radiation and chemical danger. Scenarios of combat operations played out in tactical and special tactical exercises give an idea of the scale of possible consequences.

The version where the enemy attempts to achieve partial or even total loss of combat effectiveness through nuclear and chemical strikes against a defending or attacking motorized rifle (tank) regiment usually is taken as the base variant. Two or three battalions will end up in zones of radioactive and chemical contamination. Around 100 pieces of combat and transport equipment will require complete decontamination and 500 sets of clothing and individual protective gear will require chemical decontamination.

No less intense a situation should be expected during fighting near enterprises which use virulent toxic agents or nuclear raw materials in production cycles. Personnel who have not taken protective measures promptly will receive significant doses of internal irradiation in a relatively short period of time and will become casualties in 2-3 days.

Personnel losses also should be expected in areas stricken by halogens, ammonia, cyanides, organofluoric compounds and so on.

The saturation of arsenals of many armies with precision weapons also advanced the problem of effective countermeasures against them to the foreground. Ways of resolving it are closer to the field of military chemistry. And if that is so, then NBC defense in battle specifically is needed to support performance of missions during operations under conditions of NBC contamination and to increase their degree of protection against precision weapons and other kinds of weapons and thereby reduce damage to units and subunits.

The new kind of support contains an integrated approach to its organization. The very same idea also is contained in NBC defense missions characteristic of the battle of a regiment (battalion): identifying and assessing the NBC situation with the employment of mass destruction weapons and destruction of installations with radiation and chemical danger; ensuring protection of personnel against radioactive substances, chemical agents and other toxic substances and biological agents; and reducing the signature of subunits. With respect to measures, they are taken chiefly from what is now already the former chemical support and protection against mass destruction weapons. This includes NBC reconnaissance and monitoring; collecting and processing data and information on the NBC situation; notifying subunits of NBC contamination; using individual and collective protective gear and the protective properties of terrain, equipment and other objects; decontaminating subunits, sectors of terrain and structures; aerosol countermeasures against means of reconnaissance and weapon guidance; and using radio-absorptive materials and foams.

In order for NBC defense to be effective, it is necessary to follow specific requirements in battle. First of all, it is always to be organized to the full extent regardless of whether mass destruction weapons or only conventional weapons are used. Secondly, plan it to the full depth of the battle formation and combat mission with the main body having indisputable priority. Thirdly, in any situation rely only on your own capabilities. And finally, count on support of NBC defense troops only when a measure must be performed promptly and with use of special equipment. Their maneuver must be timely and they must be reliably controlled. Let us remember that in the motorized rifle (tank) regiment there is only an NBC reconnaissance platoon made up of three squads.

Who organizes NBC defense in battle? Let us refer to the "Boyevoy ustav" [Field Manual]. This is what prescribes that the top officers of the regiment are to organize comprehensive support to combat, including NBC defense with the active involvement of a specialist, the chief of the NBC defense service. There is nothing special in this inasmuch as the fundamental principle of command and control adopted in our Army, centralization, should be observed here as well. Only the regimental commander, after studying corresponding instructions of higher headquarters and suggestions of the chief of the NBC defense service, is given the right to determine the primary NBC defense missions in preparation for and in the course of battle, elements of the battle formation whose preservation of combat effectiveness must be given special attention, the procedure and time periods for issuing NBC defense equipment and means to subunits, and so on. As the overall coordinating body, the staff controls NBC defense and monitors accomplishment of its individual measures.

But the principal "character" is the chief of the NBC defense service. He is directed to organize combat support of the regiment. And until new guidance documents are adopted, the extent of his official duties in this respect is determined by the manual presently in force with consideration of changes in terminology already approved. He must prove himself to be an engineer-specialist who understands these matters better than others.

Determining the time, coordinates, yield and kind of nuclear bursts directly for the regiment, let alone the battalion, is not typical, although it is viewed as a general mission of special importance. Nevertheless, during combat training an attempt is made to perform it by involving observers from chemical observation posts, over 40 of which are deployed in the regiment's defense. But data coming from them, obtained visually and by the simplest calculations, are unreliable and consequently predetermine serious errors in evaluating the situation taking shape. The matter can be corrected if use is made of television-optical sights at regimental SAM systems.

NBC reconnaissance is important to conduct first and foremost in areas stricken by nuclear and chemical weapons, on forward movement routes of the second echelon (combined arms reserve), in alternate battalion areas, and on supply and evacuation routes which end up in contaminated areas. Opinions that the NBC reconnaissance platoon is incapable of such missions are groundless, inasmuch as they will be performed not at once, but as necessary. One squad of the platoon constantly conducts observation and if necessary also performs reconnaissance at the regimental command post. Another squad makes up a reserve for operations as part of a detachment for mopping up in the aftermath or for performing sudden missions. Specially trained soldiers are used for observation and reconnaissance (true, only radiation and chemical reconnaissance) directly in the subunits (when disposed at the halt or in march or battle formation).

Authorized instruments permit establishing the fact of the use of nuclear and chemical weapons, measuring radiation dose rates, determining the type of chemical agents and identifying contaminated area boundaries. It is more difficult with respect to virulent toxic agents, as

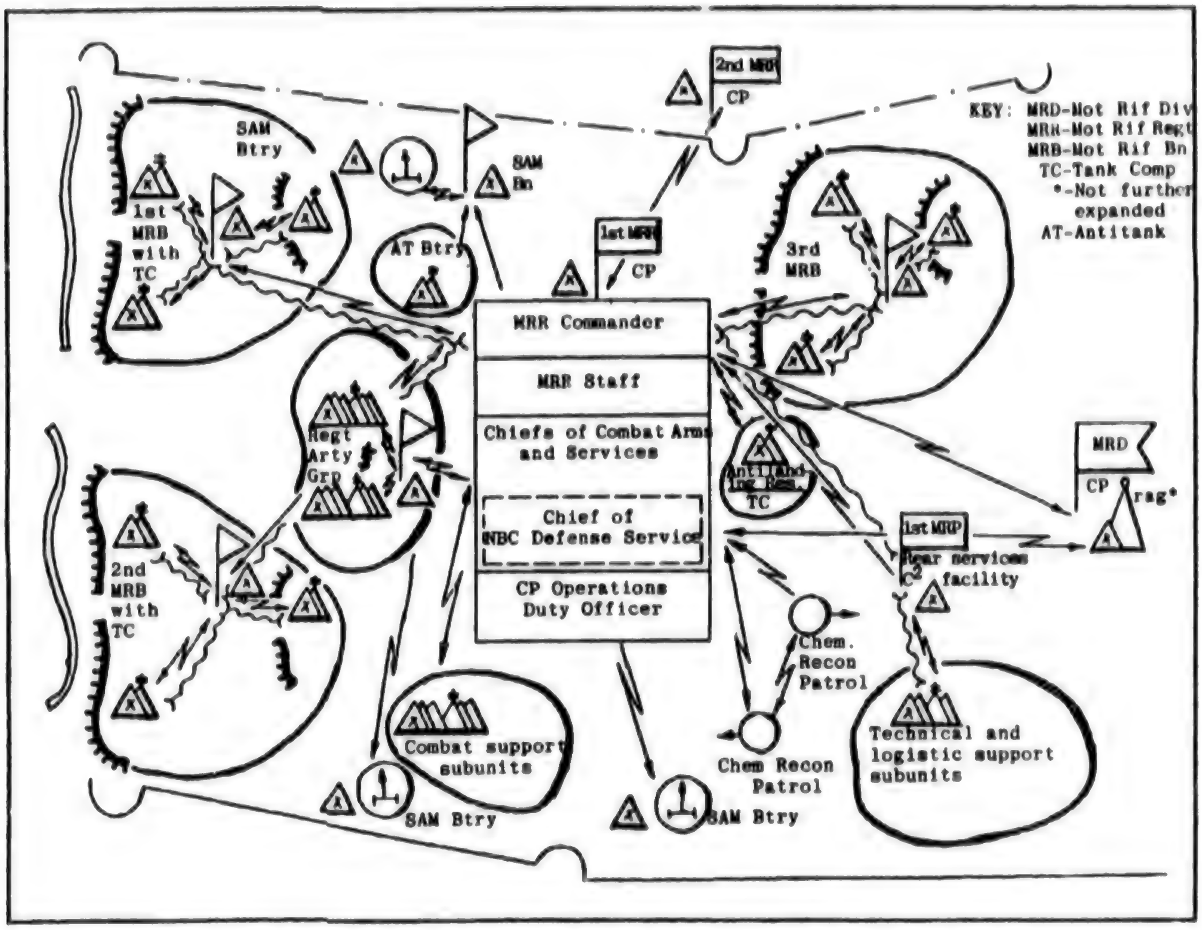


Diagram of collection of NBC situation data in a motorized rifle regiment defense

aut' orized troop equipment is not designed to detect them. The industrial UG-2 general-purpose gas analyzer would be good here, but the question of supplying subunits with it is not in the plans for now.

The chief of the regimental NBC defense service and battalion CW instructors, who hold special training courses and classes with non-T/O&E CW scouts and ensure the equipment's working capacity, are responsible for organizing NBC reconnaissance to a greater extent.

NBC monitoring in the regiment and battalion customarily is divided into monitoring radioactive irradiation of personnel and monitoring NBC contamination of subunits, the air, terrain, water and so on. This difference is determined by the methodologies used, the equipment base and the procedures used. Enormous experience has been accumulated of late concerning the first component of monitoring, especially in years of mopping up the accident at the Chernobyl Atomic Electric Power Station, but not everything is clear with respect to the others for now. Thus, the most reliable method of determining the degree of chemical contamination of any medium is laboratory research of samples. Water, soil, vegetation and food are taken using the KPO-1 and sent to the division chemical laboratory. That way is not entirely justified, for the regiment also has its own means of approximate analysis—medical instruments of chemical reconnaissance at the aid station and a portable laboratory for water purification units in the combat engineer company's field water supply squad. In certain cases they also can be used, but this is legitimate only when the degree of responsibility and duties are precisely delimited among corresponding chiefs of services in the regimental commander's directions and in staff instructions on NBC defense.

Biological monitoring is performed by medical service sanitary-epidemiological subunits. There are none in the regiment. This means the main concern of the NBC reconnaissance platoon will be only to take samples (based on ASP [not further expanded] readings) and deliver them to the regimental aid station. The chief of medical service will forward them to their destination.

Collection and processing of NBC situation data are adjusted according to a three-step scheme: observer-subunit commander-regimental (battalion) staff officer. Information is transmitted over communications channels (the diagram shows a typical version). An **NBC contamination warning system** also operates in parallel. The regimental staff, chiefs of the communications and NBC defense services, as well as subunit commanders take part in establishing it. In the preparatory stage of battle it is important to check its readiness and the personnel's knowledge of signals and to hold drills.

Warning signals remain the previous ones: "Chemical alert" and "Radiation danger." The first one is given directly by the chemical observer on detecting contamination (if only from indirect signs), and he reports this to the commander who posted him. The regimental commander announces a "chemical alert" to other subunits for which danger also exists after a finding of the chief of the NBC defense service. The factor of promptness plays the predominant role here. The "radiation danger" signal is communicated by the regimental (battalion) staff when there are increased background values of radiation dose rates to 0.5 rad/hr or more.

Advance warning also is not excluded in battle. It is possible based on results of a forecast of development of the NBC situation performed by the staff together with the chief of the NBC defense service. When the need for defensive measures in response to warning signals has disappeared, they are rescinded only based on NBC reconnaissance data.

Appropriate individual gear, terrain relief, equipment and objects are effective from the standpoint of protection only if used promptly and, even better, in combination. In the motorized rifle (tank) company, for example, all personnel can take shelter in organic fighting vehicles with air filtration and ventilation systems. A large part of the equipment in the combat engineer company, logistic support company and mortar batteries is not equipped with air filtration and ventilation systems. This means the chief of the NBC defense service must concern himself with seeing that an additional reserve of individual protective gear is established specifically in these subunits.

Motorized Rifle (Tank) Regiment Means of Aerosol Countermeasures and Their Capabilities

Means	Capabilities
Thermal smoke apparatus of tanks (infantry fighting vehicles)	Provides maskirovka [lit. "camouflage", however, includes "concealment" and "deception"—FBIS] of individual armored vehicles. Tank platoon can lay an aerosol screen extending up to 1 km and lasting 5-10 minutes with wind toward the enemy
Artillery smoke munitions	One battery can lay an aerosol screen in one minute in a 150-200 m sector with wind toward the enemy and 400-700 m with a crosswind
Tucha 902 system with 3D6 smoke grenades	Frontage of aerosol screen with a volley from 12 launchers is 165 m, from 8 launchers 110 m, from 6 launchers 80 m. Duration of intensive aerosol formation 2-2.5 minutes
Standardized smokepots	100 pots create an aerosol screen on a frontage of 1.5-2 km over a period of 20 minutes with wind toward the enemy
Incendiary smoke charges and smoke hand grenades	Provide maskirovka for the maneuver of small groups and provide for blinding of enemy weapon emplacements (observation posts)

How personnel who are defending on contaminated terrain feel is improved through the installation of filter-ventilating units in engineer structures. They are envisaged by the norms in almost all shelters erected in a regimental defense sector.

The filtering and absorbing systems of the majority of combined arms protective masks and filter-ventilating units (air filtration and ventilation systems) are characterized by a limited time of protective action against a number of virulent toxic agents. During preparation for battle the chief of the NBC defense service must provide personnel either with self-contained breathing gear or with industrial protective masks, and provide the necessary reserve of DP-2 supplementary cartridges for subunits defending in permanent emplacements.

Complete decontamination is the regimental commander's prerogative. He alone makes the decision to conduct it by permission of the senior commander. Decontamination can be conducted both in battle formations as well as with removal of subunits to uncontaminated terrain. But in any situation the personnel are obligated to use the formulation from the chemical warfare decontamination kit for chemical decontamination of exposed portions of the skin, clothing, gear and small arms.

The state of supply of subunits with organic and authorized means is considered sufficient to independently perform complete decontamination, although this is far from so in practice. For example, BMP-equipped motorized rifle companies and tank companies with TDP tank radiological decontamination sets have limited capabilities. Decontamination in battle formations takes 2-3 times longer than at previously prepared decontamination stations.

Aerosol countermeasures against means of reconnaissance and weapon guidance have been well known since

Great Patriotic War times as smoke maskirovka. True, today the views are somewhat different on the place of smokes in battle and there is more advanced smoke generation equipment.

Air Defense Fighter Aviation in WWII

95UM0324I Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 38-41

[Article by Major General of Aviation Nikolay Konchev, Red Banner Military Academy of Air Defense imeni Marshal of the Soviet Union G. K. Zhukov, under rubric "1945-1995": "By Fire and Maneuver, by Propeller and Wing, Air Defense Fighter Aviation Pilots Defeated the Enemy in the Great Patriotic War"]

[FBIS Translated Text] The fiercest engagements with a strong, experienced air enemy were waged by air defense fighter aviation during 1941-1943, when fascist German troops were driving toward the country's central areas. These years account for over 73 percent of sorties flown by air defense fighter aviation for the entire war and 60 percent of enemy aircraft shot down—mainly (around 62 percent) bombers, which made up the Luftwaffe's chief striking force. At that time their destruction was one of the most important missions of air defense aviation. Another no less important one was to cover major administrative-political centers and industrial regions against air strikes, for which from half to three-fourths of all air defense fighter aviation forces were used in various periods of the war. In addition, it took part in Red Army defensive and offensive operations, in sealing off encircled enemy groupings, and in supporting combat operations of our bombers and attack aircraft; it also covered the lines of communication and rear of operating fronts, sea convoys, and airborne assault forces, and it conducted reconnaissance... And from the latter half of 1944 a part of its forces (2nd Fighter Corps and 1st VIA [Fighter Army]) was put into action to repel possible strikes against Moscow and Leningrad by unmanned buzz bombs and glide bombs.

The nature and features of performance of a particular mission influenced the choice of methods of combat operations. Usually air defense fighter pilots were on ground alert with subsequent takeoff for intercept and destruction, they patrolled in the air, they conducted a roving patrol, they escorted friendly aircraft and trains en route and so on. The fighter sweep (roving patrol) became the most effective of the methods used in the war—target-of-opportunity rovers expended an average of only 3-4 sorties for one destroyed enemy aircraft. As a comparison, 21.4 and 170 sorties of our fighters were expended from ground alert and airborne alert status respectively. Methods of combat operations were constantly improved. Increased results of air defense fighter aviation in repelling mass enemy air strikes was achieved by moving airborne alert zones to enemy-occupied territory, by favorable alignment of formations, by vertical separation, by wide use of vertical maneuver in air-to-air combat and so on.

We will also note the following eloquent fact: on entering the war, air defense fighter aviation had 40 fighter regiments (1,500 aircraft) in its makeup, and by May 1945 it numbered 107 fighter regiments (4,632 aircraft). And in this time its aircraft fleet was renewed three times. Ten types of Soviet and seven types of foreign aircraft were mastered and 2,935 domestic fighters and 6,953 lend-lease fighters were received. Such a clear dominance of makes of foreign aircraft (65 percent) was explained by the fact that they were more suited in tactical performance characteristics for combating bombers than for performing missions on the battlefield.

Naturally this required quality mastery of different types of fighters and continuous improvement of operating tactics of air defense fighter aviation as a whole. Despite the extremely difficult conditions, our pilots and air commanders were defeating the enemy already in the first period of the Great Patriotic War (22 June 1941-18 November 1942). Suffice it to say that during that period they destroyed 2,617 enemy aircraft in air-to-air combat and on airfields, losing 1,175 aircraft and 489 pilots in the process. Views on aligning formations were revised: a flight began to consist of four aircraft made up of two interworking pairs. A new element of air defense fighter aviation tactics was night air-to-air combat of fighters in and outside of searchlight-illuminated areas. In this regard our pilots gained considerable experience in repelling enemy air raids on Moscow and Leningrad. Air defense fighter aviation also received practice in organizing air cover of friendly troops on the battlefield and in delivering ground attacks against enemy airfields and ground groupings.

Air defense fighter aviation tactics continued to be improved in the second period of the war (November 1942-December 1943). Our fighter pilots employed various tactics and methods of combat operations, taking advantage of the quantitative and qualitative edge over enemy aviation. Air-to-air combat became multiple-aircraft combat. The main maneuver in it was vertical and the chief means of control was the radio. Such methods of combat operations as the roving patrol and sealing off of enemy airfields began to be introduced more actively, largely facilitated by new types of fighters becoming operational and by bold use of formations dispersed frontally and from front to rear, the basis of which was an aircraft pair. Control of fighters in the air and from the ground became more precise and interworking with friendly AAA improved. The first experience of mass employment of air defense fighter aviation also fell in this time: in May 1943 105th Fighter Division at full strength "worked over" the area of the Bataysk rail center. And in the course of the counteroffensive at Stalingrad 102nd Fighter Division successfully performed a completely new mission—sealing off an encircled enemy grouping from the air.

The result of air defense fighter aviation operations in the second stage was 933 enemy aircraft destroyed; friendly losses were 278 aircraft and 155 pilots.

In the third and final period of the war (January 1944-May 1945) air defense fighter aviation conducted combat operations under conditions of our aviation's total superiority. Luftwaffe activeness had fallen off noticeably. At the same time, the threat of strikes against individual vital installations in the rear of the country in which heavy bombers (He-177, FW-200) and V-1 buzz bombs might be used had not diminished. Protecting these installations from the air remained one of the primary missions along with those such as covering rail and water lines of communication of fronts and the airfields of front and long-range aviation and participating in sealing off encircled enemy groupings from the air. Air defense fighter aviation took an active part in concluding operations of the Great Patriotic War—Berlin (310th and 320th fighter divisions) and Prague (141st Fighter Division)—in covering lines of communication and crossings in the area adjacent to the front (including across the Oder, Vistula and Danube).

In this period our pilots' tactical proficiency continued to be honed in intense air-to-air combat. The system of control of fighter units and subunits and of tactical elements during their performance of various combat missions saw further development, which considerably increased the effectiveness of air battles (the ratio of aircraft shot down to aircraft lost was 6:1 in our favor). Multiple-aircraft combat began to be more organized and purposeful in nature. Vectoring of fighters using radars became widespread, because of which the results of air defense fighter aviation combat operations almost tripled (in 1945 53 of our fighter sorties accounted for one enemy aircraft shot down, but in 1943 it was 155 sorties). Night combat tactics improved. Fighters with airborne radars (Gneys-2) began to be used beginning in May 1944, and airborne targets were destroyed at high altitudes. Air defense fighter aviation actively employed not only a tactical maneuver, but also flights to full range with landing at intermediate airfields. In the concluding stage it destroyed 620 enemy aircraft while losing 135 aircraft and 80 pilots.

Air defense fighter pilots displayed unparalleled courage and heroism, tactical proficiency, outstanding inventiveness and innovation in air-to-air combat. They defeated the enemy by fire and maneuver and, if the situation forced them, by propeller and wing. Confirmation of this is that more than 100 pilots employed ramming during the war years. Among them was B. Kovzan, the only air defense fighter pilot in the world who employed a ramming attack four times.

Air defense fighter aviation flew a total of 270,116 sorties in the Great Patriotic War and destroyed 4,170 enemy aircraft, which was 57 percent of all fascist German "vultures" shot down by Air Defense Troops. Its losses in air-to-air combat and to the fire of AAA during ground attack operations against ground troops and enemy airfields were 1,588 aircraft and 724 pilots. The Motherland highly esteemed air defense fighter aviation combat activity. Seventeen of its units and formations were given Guards designations, the services of four of them were recognized by conferral of honorary names, and the Hero of the Soviet Union title was bestowed on 92 pilots, and on A. Karpov twice.

Accumulated frontline experience has been used actively in postwar years for developing air defense aviation and building up its combat might in accordance with modern Russian military doctrine.

Basics of Mine Warfare

95UM0324J Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 42-45

[Article by Colonel Ivan Nikolayev: "This Difficult Mine Science"]

[FBIS Translated Text] *Piratic attacks—more frequent of late—on Russian military installations located in unfavorable regions of the near abroad, on weapon and ammunition depots, and on posts of peacemaking forces demand use of more effective security and defense procedures. Among them is the installation of explosive obstacles. Under their cover, troops will feel stronger and psychologically more stable even at positions when conducting combat operations. This is why each soldier should master the secrets of minelaying. Colonel Ivan Nikolayev tells how to organize and conduct training in a methodologically correct manner.*

Combat training programs of almost all subunits without exception (motorized rifle, tank, artillery, NBC defense and so on) provide for studying the topic "Artificial Obstacles: Installation and Breaching." A total of seven hours is set aside, including three in the winter training period.

It is best to conduct classes by platoon on a tactical training field under the direction of the company commander and chief of regimental engineer service.

Inasmuch as demolition accessories are among objects to be handled extremely carefully, safety regulations should be studied carefully with personnel on the day before in hours of self-training. To instil in subordinates a sense of responsibility for their life, all work with training explosives, fuzes and mines is to be conducted as if with live ones.

Preparation of training facility. One cannot get by with posters alone here, as is the practice in some subunits. The company commander must personally see that training mines, fuzes and so on are drawn from the regimental military-technical property depot.

Any matter needs appropriate "leaven." In our case, to interest trainees in the importance of the class it is apropos to recall episodes from the Great Patriotic War, combat operations in Afghanistan and the participation of Russian troops in peacemaking operations. It is important to intelligibly show the role in battle of different kinds of artificial obstacles, above all explosive

obstacles as being most effective from the standpoint of destroying enemy personnel and equipment.

Minefields, mine clusters and individual mines laid on probable avenues of enemy appearance are widespread types of explosive obstacles. Antitank or antipersonnel mines or trip flares are used in installing them depending on the goal pursued.

After that brief introduction, shift to the main part of the class, but this time at training points (figuring one for each platoon), where platoon commanders and NCO's will be the instructors. Initially it is advisable to study mine weapon equipment and rules for installing and disarming mines.

The names of mines indicate their purpose. For example, antitank mines are emplaced on the terrain against mobile equipment: tanks, self-propelled artillery, APC's and motor vehicles. They are subdivided in turn into track-disabling, belly-attack and horizontal effect mines. The first kind "hunts" for elements of the running gear (tracks, rollers, wheels), the second penetrates the bottom, damaging transmission assemblies, and the last one breaches side armor and the hardware and armament behind it. I am not speaking about fighting vehicle crews, because essentially all encounters with mines end regrettably for them.

The TM-62 is a typical antitank or, more accurately, track-disabling mine. Its following modifications differ in material used for making the body: M—metal, D—wood, P—plastic and B—without any body at all (pressed TNT is coated with a protective varnish). Their makeup is almost identical in other ways: explosive charge, booster and one of the following fuzes: MVCh-62, MVZ-62, MVP-62 or MVSh-62. The latter fuze (a so-called rod-type fuze) is used to transform the TM-62 mine into a belly-attack mine.

Explain from a poster without fail, or better, from a cutaway mockup of a mine so it is possible to understand graphically both the design and principle of operation of the engineer munition.

How does a mine operate? It is a simple scheme: the explosion of the main charge is initiated by actuating a fuze screwed into the mine in place of the shipping plug; it is tightened by a special wrench, the safety pin is removed, and it is armed. (A mine is disarmed according to this same algorithm, but naturally in the reverse order—I.N.). Everything after this occurs automatically. In the MVP-62, for example, the stem of a button countersunk flush with the cover assembly releases the slide from the locking yoke. Because of the spring's elasticity, the slide forces air out of the bellows through an opening in the diaphragm. The slide reaches the stop in 20-30 seconds and the detonator is positioned opposite the striker pin and booster charge. When driven over, the fuze cover fractures along a weakened section and presses on the striker. Its lugs break off and then...

There are a number of restrictions which must be mentioned. It is categorically prohibited to use fuzes with cracks or to store and carry them in an armed state or with EDP-R electric detonators. A mine that has just been removed and prepared for transportation can be laid again only after ten minutes.

Now the time has come to reveal the secrets of laying antitank mines under various climatic conditions and to give at least two or three trainees an opportunity to lay mines independently.

The belly-attack mine only operates effectively when it goes unnoticed by an armored vehicle crew. This is why an attempt is made to bury them in the soil either using minelaying equipment or manually. We will dwell on the second method inasmuch as towed minelayers are organic only to combat engineer subunits.

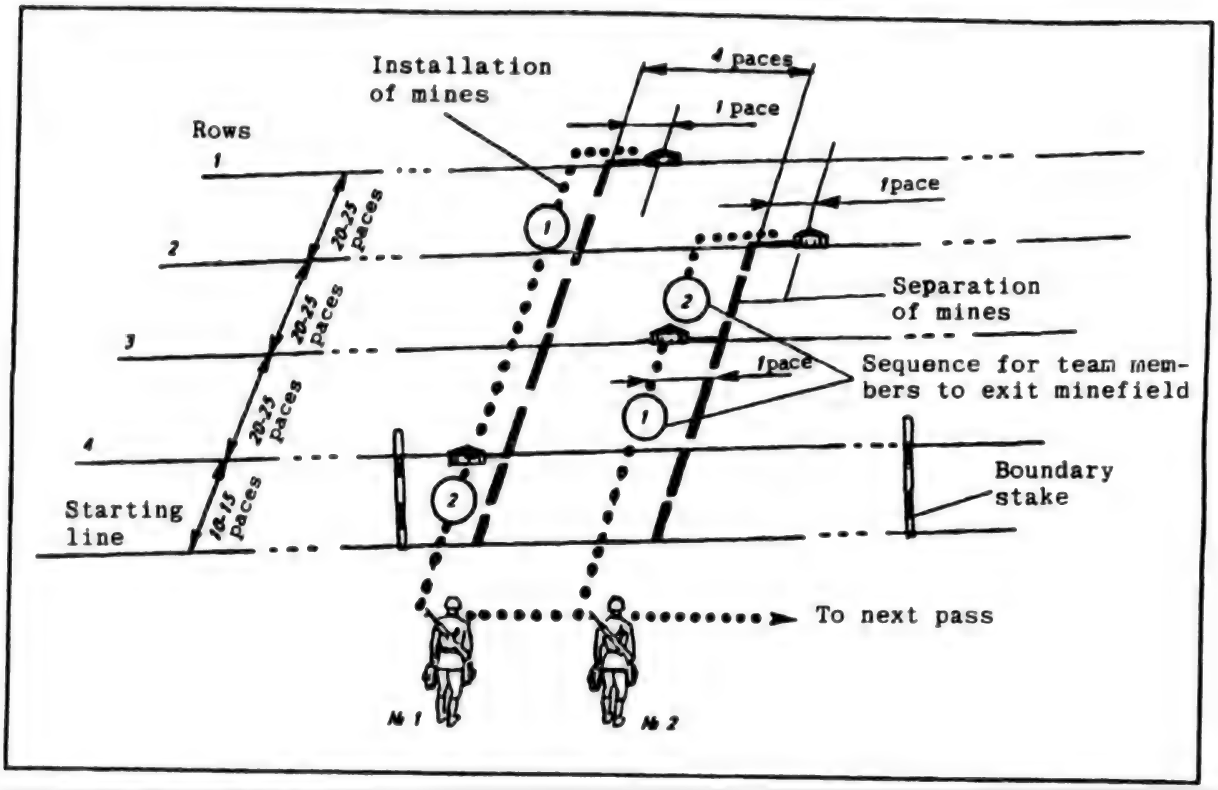
In the warm time of year dig a hole for pressure-initiated mines after first cutting and folding back a layer of sod 0.6x0.6 m in area in the direction of the enemy. Before screwing in and arming the fuze, cover the body of the mine with soil, tamp it down, then overlay it with a "coverlet" of vegetation. To be plausible, the height of the hummock should not exceed 2-3 cm, or even less in loose soil—sand, peat, fresh plowland. Carry excess soil to one side and scatter it. Lay a panel of boards or a mat of brushwood 2-3 times the mine's diameter beneath the mine on marshy soil or soil that has become swollen from thawing.

Belly-attack mines are handled in approximately the very same way. The only difference is that the fuze pin is pushed outside through a cut in the sod, and sectors with high grass or small bushes are chosen for emplacement.

Be reasonable with maskirovka [lit. "camouflage", however, includes "concealment" and "deception"—FBIS]. Never lay antitank mines in depressions and gullies or next to stumps and boulders. Even in battle, tanks drive around these natural obstacles of little significance to them.

In winter and in areas with especially firm soil, the place for mines is on the surface. If there is snow, that is fine: there will be something to use for camouflage. When the depth of snow cover is over 25 cm, first tamp it down. A mine laid in a recess is covered with an 8-10 cm layer. Then we wait for a snowstorm or newly fallen snow to hide the "fruits" of our work from the enemy once and for all.

It is not enough to lay a mine. Know how to "remove" it. There are many fine points here, and beginning mine specialists must bear the following in mind. Only those antitank mines emplaced without antihandling devices are subject to disarming. But if their cover assembly, fuze or body is damaged or if they are located near craters from artillery shellbursts or have frozen into the soil, then it is advisable just to detonate them in place with charges placed on top.



Familiarization with antitank mines can end with this. After brief questions the training instructor redirects trainees' attention to mines of another variety—antipersonnel mines.

The PMN-2 fuzed high-explosive pressure-initiated mine is used most often. It is armed automatically after the pin is cut off and the safety stem removed. When the cocked linkage is pressed, the striker pricks the detonator and... there is an explosion.

The mine is laid according to the very same rules as the antitank mine, but it requires more delicate handling. It is definitely stored and transported in packaging, and the body of a mine already laid in a hole must not be squeezed. And it is categorically forbidden to remove them; just destroy them.

The most important part of our brief class remains—to learn to lay minefields in practice.

In essence, any minefield consists of individual mines laid according to a certain scheme. The company commander determines the rows and distance between them, the interval between mines and their expenditure. His duties also include a topographic survey and compilation of a log of a prepared minefield.

Mines are laid by the team drill method in motorized rifle and other non-combat-engineer subunits. This is acceptable when there is no enemy fire pressure. Platoon personnel form up on a starting line, each with two mines brought from the field depot. Each serviceman in a rank receives the number one or two. At the senior person's command, everyone advances 10-15 paces. The number ones lay one mine each one pace to their left. Then the number twos lay their mines every 20-25 paces successively to the left and right of the axis of movement and remain in place. The number ones move to the last row.

The command is given to all: "Begin installing mines." While holes are being dug, squad commanders issue fuzes and monitor their subordinates' work. Servicemen leave the intermediate rows in pairs—the main one and the team member who has moved up to him. At the initial line safety pins are collected from all emplaced mines. There is another "filling" with mines, and everything is repeated from the beginning...

There also are other more convenient options. Servicemen take 3-4 mines all at once. They enter the future minefield at an interval of six or eight paces and advance in a staggered arrangement, displacing two paces toward the right-flank neighbor on the line of each row. Mines are armed on the reverse path. Boundary stakes are removed and carried to a new minelaying belt.

Antipersonnel minefields are emplaced in the very same manner, only with high-explosive pressure-initiated

mines. True, there are slight features. First of all, there must be an even number of rows, two or four. Secondly, the distance is reduced substantially between rows (to 2-4 m) and between mines (1 m). And thirdly, minelaying begins with the first row from the enemy. A team member takes all mines issued for one pass with him right away.

And the last methods advice. In order for trainees to be successful in this complicated science, subunit commanders should not limit themselves in any way to that meager time set aside by the subject matter of engineer training. Give subordinates an opportunity to engage in mine warfare in any tactical class. The fact is, only in this way, in the course of numerous drills, is it possible to instill stable skills in organizing explosive obstacles.

Defense, Security of Battalion Rear Services

95UM0324K Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 53-55

[Article[1] by Colonel Vladimir Vorsin, candidate of military sciences, staff of Armed Forces Rear Services: "Prescribed for the Regiment, But Not the Battalion: On Logistic Support of a Motorized Rifle Battalion in the Defense"]

[FBIS Translated Text] **2. Defense and Security.**

Survivability of battalion rear services in battle depends largely on the effectiveness of NBC defense measures and on reliable defense and security of installations.

The goal of NBC defense is to reduce personnel losses to the maximum extent and ensure performance of missions under conditions of NBC contamination and enemy use of precision and other kinds of weapons.

In the defense a battalion also will have to operate under air and artillery strikes and repel assaults by tank and mechanized subunits and raiding parties. Therefore rear services above all have to preserve their combat effectiveness and ensure the battalion's successful performance of missions.

To reduce the effectiveness of enemy nuclear strikes and possible losses, it is necessary first and foremost to carry out measures to disperse rear services personnel and equipment. In addition, a very serious approach should be taken to measures for maskirovka [lit. "camouflage", however, includes "concealment" and "deception"—FBIS] of subunits and installations.

Based on experience of the Great Patriotic War and postwar exercises, use of the terrain's protective and concealing properties decreases the likelihood and degree of enemy effect and reduces the need to perform work of preparing shelters and maskirovka of rear services disposition areas.

This is why wide use is made of forests, undergrowth, ravines, hollows, reverse hillslopes, large and small ditches, pits and so on for accommodating subunits under any circumstances. At the same time, in choosing them remember safety measures in case of a storm, torrential rains and hurricane-force winds.

I recall one characteristic episode. During a tactical exercise in mountainous terrain a motorized rifle battalion was ordered to go over to the defensive. Its commander in turn specified the deployment area for rear services and the procedure for logistic support of combat subunits. In performing the assigned mission, rear services specialists began engineer preparation and maskirovka of the occupied area. Priority work basically had been completed toward evening. It seemed everything was going according to plan.

But the weather deteriorated and it began to rain about two hours before dawn. When the rain stopped, a depressing picture opened up to our gaze. Rear services equipment placed in low areas next to dried-up streamlets had been washed away by raging torrents. It was learned that in a period of rains the water in these places rises 1.5-2 m, as a result of which streamlets turn into real mountain rivers.

Fortunately, the equipment was not washed far. Nevertheless, this reflected on the time periods for performing the mission. This is what ignoring features of climate and terrain can lead to.

Canvases, tents, protective covers, greatcoats, ponchos, mats made of green branches and grass, and other improvised means are used to protect rear services against mass destruction weapons and incendiary agents in addition to using concealing properties of the terrain. Containers, especially sealed containers, play an important role. They not only protect contents against contamination, but also considerably facilitate their radiological decontamination.

To reduce the effectiveness of enemy use of reconnaissance-strike complexes, rear services equipment is covered with radio-absorptive and radio-scattering paints, and infrared and thermal decoys are used to make dummy rear services installations. It is advisable to perform engineer maskirovka work at night, and in the daytime one camouflages using smokes and aerosols.

Along with protective and concealing properties of terrain, engineer structures are used for sheltering rear services subunits in the defense. Slit trenches, trenches, and dugouts for personnel are prepared above all. Experience has shown that it is most advisable to construct slit trenches that are strengthened successively. In preparing them, after the pit is dug a cover is immediately laid on and partially bermed, then revetment and a protective door are made. Such a sequence permits ensuring protection of personnel against penetrating and thermal radiation even before work is completed.

As a rule, rear services subunits engage in preparing shelters. If the opportunity exists, personnel and equipment are assigned to help them from attached combat engineer or motorized rifle subunits by decision of the battalion commander.

Radiological, chemical and bacteriological (biological) monitoring of contamination of rear services personnel and equipment and of stores of supplies, food and water is performed in all rear services subunits. It should be remembered that the length of time rear services specialists are present in contaminated areas depends on how long the personnel are capable of wearing protective gear. Exercise experience shows that with good conditioning, a protective mask should not be worn continuously in excess of seven hours, and a protective poncho (chemical protective suit) in excess of 2.5-3 hours at a temperature up to +15°C. Personnel must be given a rest in shelters at the expiration of these time periods.

Rear services security is accomplished for purposes of promptly warning personnel about a ground or air enemy attack and for preserving armament and equipment of rear services subunits and stores of supplies against theft. Guard duty and local security are organized in each rear services subunit for this purpose. Observation and sentry posts and patrols are posted and non-tactical patrols are sent out in disposition areas.

Experience shows that the number of personnel assigned for security, patrolling and traffic control service depends on the nature of terrain, visibility conditions, importance of installations, the distance of rear services subunits from each other, and the size of their deployment areas.

For example, from 2-3 persons to a squad are assigned to a security post for covering roads and trails leading to deployment areas of rear services subunits.

A listening post (2-3 persons) as a rule is posted for a certain time at night or when there is limited visibility. In organizing security of rear services installations by patrolling, a sentry is assigned a sector extending from 500 m to 2 km in daytime and from 200 m to 1 km at night depending on conditions. At the same time, exercise experience has shown that sentries also can accomplish security by observing from foxholes, slit trenches and natural cover, and in the daytime with favorable terrain conditions also from specially prepared towers.

All these measures unquestionably require the involvement of a large number of people. Is it possible to reduce their number? It is, and above all through use of technical surveillance equipment, security signaling and obstacles. A second way is to outfit rear services subunits with modern equipment having a high degree of survivability and to adopt more powerful means of destroying enemy personnel and ground and airborne targets.

Defense of rear services as a rule is organized according to the very same principles as combat duty in motorized rifle and tank subunits when disposed at the halt.

Exercise experience shows that organic rear services personnel and equipment above all are used to repel an enemy attack. In addition, weapons and combat equipment being repaired in the disposition area of rear services subunits together with crews, teams and drivers, and also lightly wounded and nonseriously ill persons capable of fighting can be used. In some cases, combat subunits are assigned to defend rear services by decision of the battalion commander.

The experience of the Great Patriotic War and modern local conflicts attests that rear services installations most often come under attack by enemy raiding and reconnaissance parties or detachments. Rear services subunits also may end up in an area of operations of tactical airborne assault forces, subunits of airmobile troops, and groups of fighting vehicles or individual fighting vehicles that have penetrated the FEBA.

Therefore one should strive to establish a perimeter defense. In rear services subunits disposed in one or more nearby areas, one should prepare platoon type strongpoints or squad positions to repel an attack by enemy raiding and reconnaissance parties or detachments.

In addition, establishment of a reserve group must be provided for in the allotment of battle tasks. And of course, it is necessary to constantly teach personnel of rear services subunits to fight groups of infantry, tanks, parachutists and members of raiding parties who have penetrated.

Air defense of rear services subunits is accomplished in the battalion's overall air defense system. Warning signals are the very same as for combat subunits. If necessary, commanders can establish their own signals. Rear services personnel must be able to conduct fire against low-flying enemy aircraft and helicopters.

(To be continued)

Footnotes

1. Continuation. For beginning see ARMEYSKIY SBORNIK, No 6, 1994.

EQUIPMENT AND ARMAMENT

Operation of T-80U Main Battle Tank in Winter

95UM0324L Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 56-59

[Article by Colonel Grigoriy Shcherbakov, candidate of technical sciences: "Winter Is No Hindrance for the T-80, but..."]

[FBIS Translated Text] *The T-80U main battle tank rightly is considered one of the best in the world in firepower, speed, trafficability and obstacle crossing. The practical recommendations offered for the readers' attention will help crews and specialists maintaining the T-80U to preserve power plant reliability at the requisite level and achieve the effectiveness put into the design for using this combat vehicle, especially in winter.*

The T-80U power plant includes the GTD-1250 triple-shaft gas-turbine engine, systems supporting its operation, and special equipment increasing the vehicle's technical combat readiness, mobility and reliability.

The GTD-1250 gas-turbine engine has high starting qualities. A reliable engine start with ambient air temperature to -50°C is ensured with a technically serviceable condition of starting system elements and use of IPM-10 grade oil (the main oil) in the oil system. But observance of a number of conditions is necessary for this.

Above all fuel put in the tanks must not contain water. The lengthy effect of water leads to corrosion and breakdown of fuel-feed, regulation and engine protection equipment. Formation of ice plugs in equipment lines changes its characteristics. In a number of cases fuel pressure increases by 5-6 kg/cm^2 during start. The combustion chamber fuel-air ratio is disturbed, which leads to scorching of nozzle vanes and impeller of the high-pressure compressor turbine. Something else also is possible—pressure created by the plunger pump is not enough to open the shut-off valve of the NR-1000FM pump-regulator and the engine does not start. The reason is the improper position of the constant fuel pressure differential slide valve in the pump-regulator's metering device.

Water enters tanks chiefly during fueling: either it was in the fuel before fueling or moisture was absorbed from outside air with improper conduct of this operation (fueling with an open stream). The likelihood of water entry increases with use of jet fuels having greater hygroscopicity than diesel fuels. To avoid water contamination of fuel, tanks should be filled with a closed stream, using a fuel tanker or the fueling device built into a tank.

A sensor is mounted in the lower part of the service tank to monitor the presence of water in fuel; it sends a signal to an indicating light on the driver's instrument panel. If the light is on after the storage battery switch is turned on, sediment must be drained from the service tank until the light goes out.

Fuel is poorly atomized by injectors because of low temperature, which worsens the carburetion process in the combustion chamber. An increased range of fuel jets coming from injectors may cause drops to settle on the chamber reflector surface. After ignition of the fuel-air mixture, this will sharply increase gas temperature at the high-pressure compressor turbine inlet and will lead to scorching of nozzle vanes and impeller.

To improve fuel atomization when staring the engine under negative temperature conditions, the "ZAPUSK VDUV" regime is used. Compressed air under a pressure of 5+0.5 kg/cm^2 is supplied from air system cylinders through the second orifice of dual-orifice fuel-injection nozzles. This regime is used when starting an engine on diesel fuels and with their mixture with RT, T-1 and TS-1 jet fuels if the tank is parked for over three hours. The signal for opening the solenoid-operated pneumatic valve for delivering compressed air is put out by the PUS-71 automatic starting device in the 10-55 second functioning interval of the starting cyclogram. Operation of the device is monitored from the drop in cylinder air pressure during the time it is on.

If the engine was mothballed, before it is started the TKR [not further expanded, possibly turbocompressor] rotors are cranked twice (it is recommended that this be done from an external source) to remove preservative oil and remaining fuel from cavities of the fuel-feed, regulation and protection equipment. When demothballing, the manual fuel-feed lever must be in the pump-regulator emergency stop valve open position (on the forward stop), otherwise equipment cavities will not fill with fresh fuel and consequently the engine will not start.

While cranking, monitor rotational speed of TKR rotors in the eighth second of working off the cyclogram. When the P2G-12 switch is placed in the TKI [not further identified, probably first-stage turbocompressor] position, rotational frequency of the first-stage turbocompressor rotor should increase (by several scale divisions). At the expiration of that time, rotational frequency of the second-stage turbocompressor rotor should be at least 24 percent (switch P2G-12 in TKII [not further identified, probably second-stage turbocompressor] position). An absence of readings indicates rotor support bearings are seizing or the electric power source is excessively discharged.

Before starting the engine on gasolines, monitor temperature in the flow passage [protochnaya chast] on the ITG-2 instrument. It should not exceed 200°C to avoid a gasoline vapor explosion.

On completion of pumping-through a gasoline-filled fuel system, switch 2PPN-45 must be placed in the "NASOS" [PUMP] position. In this case the BTsN-2 centrifugal gasoline pump, operating under high-speed conditions, has greater capacity than in the "Pumping-through" regime and provides for removal of vapor locks and air locks from fuel lines. Not following this rule can lead to failure to start the engine. After "throttling," the manual fuel-feed lever must be used to set the TKII rotor rotational frequency within limits of 87-88 percent. At a lesser frequency the engine will operate unsteadily, right down to stopping, due to a sharp decrease in mass fuel feed to the combustion chamber. Operating the engine on gasolines in the parking idle regime is prohibited (for the very same reason).

To increase engine power between seasons (spring, fall), manual adjustment of the "Winter-Summer" fuel maximum consumption limiter (OMR) screw is envisaged; in the "Summer" position it permits introducing fuel metering according to the law Gt=const with an air temperature of 0°C, and in the "Winter" position at 10°C. This provides for a power increase in the 0-15°C range of air temperatures (hatched area in Fig. 1).

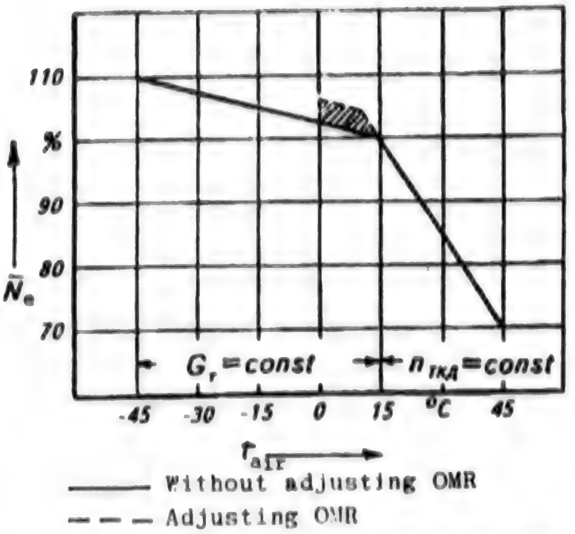


Fig. 1. Change of GTD-1250 engine power according to control curve

The OMR screw is on the NR-1000FM pump-regulator beneath the automatic starter air filter. It is placed on the "Summer" stop by pressing on the nut in the direction of the pump to disengage it from the housing, then turning it counterclockwise (to the left) to the stop. A red band should be visible along the vertical axis of the nut housing (on top). To place the OMR on the "Winter" stop, turn the nut clockwise to the stop—a black band should be visible along the vertical axis of the nut housing (on top).

In preparing a tank for winter operation flexible screens and fine mesh screens over the inlet louvers must be replaced with coarse mesh screens. It is possible not to replace them in regions with winters with little snow and also with the tank's lengthy movement over forested terrain, but in this case inspect the screens and if necessary clean them of snow and ice before starting the engine after being stopped for two or more hours.

In the process of operating a tank under conditions of deep snow cover, in a snowstorm, or in a blizzard, keep a large amount of snow from getting on the inlet louvers and in the air cleaner cyclones. A reduction in the inlet path flow section leads, first of all, to a drop in engine power because of the need to reduce fuel feed to the combustion chamber to avoid a gas temperature increase above that permissible ahead of the TKII compressor turbine; and secondly, to a disturbance in design air flow along blade passages of compressor and diffuser impellers, which periodically leads to intensive air flow interruptions with the rotational frequency of TKR rotors preserved. As a result of this, irregular high-frequency oscillations of air appear at the entrance to the compressors, the amplitude of which gradually increases and frequency decreases with a further decrease in its consumption. Surging arises as a result. Fluctuation of speed, pressure and consumption leads to vibrations of compressor blades and flow passage elements, to a drop in engine power, to a flame-out and even to engine failure. As a rule, surging is noted under conditions of tank acceleration.

A deflector (included in the separate set of tank spare parts, tools and accessories) should be used for snow removal from louver grids and from air cleaner cyclones during daily maintenance and also at halts when making marches under the conditions indicated; it is fastened to the extension of the outlet louvers (as shown in Fig. 2) with the engine not operating. After starting the engine set the TKII rotor rotational frequency at 83-85 percent and warm up the cyclone louvers for 10-15 minutes. It is undesirable to establish a greater rotor rotational frequency for economic considerations and because of the possibility of the deflector tearing from the fastenings. At a lesser frequency the expected effect will not be obtained.

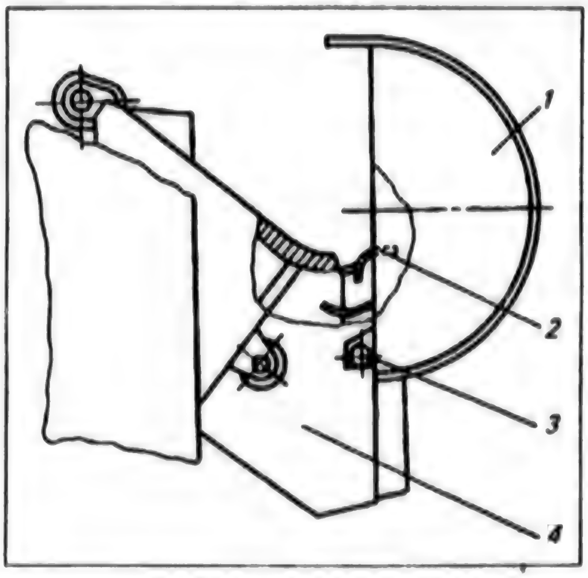


Fig. 2. Deflector working position

Key:

1. Deflector	3. Axis
2. Clamp	4. Extension of outlet louvers

Water which has formed as a result of melting snow partially enters the flow passage, which presents no danger to engine operation, and part of it is removed through air ducts by the fans which suck dust from air cleaner dust collectors and which cool oil in radiators.

It is possible to warm up inlet louvers and cyclones in windy weather by placing the tank with its rear against the wind for 10-15 minutes. To avoid damaging the engine, warming up the engine-transmission compartment by that method under any conditions except those indicated is prohibited.

If the tank is on an open parking area in wintertime do not allow water and snow to get into the air cleaner cyclones; use the protective mat for inlet louvers or canvas for this. Water which has entered the cyclones runs off into the dust collectors, then into the dust suction and oil cooling fan housings. It runs to the bottom of the tank through leaf-type valves of housings. But in very low temperatures of outside air and of engine parts it is possible that water which remained in the housing will freeze. If its level is more than 40 mm, the fan impeller freezes and the impeller drive shaft may break with the next engine start. In this connection air suction through engine oil system radiators and the lubrication and transmission hydraulic control systems will stop.

It is possible to detect a shaft break when moving from the oil temperature level in the systems indicated with a normal amount of oil in oil tanks. to make sure of the shaft's serviceability, with the engine operating in place in an idle or parking idle condition, bring the hand up to the end parts of air ducts in turn. The presence of an escaping air flow attests to serviceability of the fans.

It is also possible for water to enter the housing of the central fan, which supplies air for cooling the GS-12TO and GS-18MO starter-generators and the AK-150SV air compressor. A break in the fan drive shaft may lead to failure of these elements because of their overheating. Fan serviceability is checked with the engine operating in idle or parking idle conditions with an open cover above the engine-transmission compartment by the presence of an air flow at the outlet from ports in the GS-12TO housing cover flap.

It is possible to substantially reduce the settling of snow dust on inlet louvers by using an air intake with or without an additional branch pipe. In all cases, a guide cap must be installed on the upper part of the air intake, ensuring the intake of air when the tank is moving away from the front of the housing. The branch pipe and cap are included in the separate set of spare parts, tools and accessories. When the air intake is in a working condition, turret rotation is precluded because of an interlock. Information on the interlock lights up on the tank commander's control panel.

During air system maintenance, give special attention to serviceability of the valve for discharging condensate from the moisture separator. It is common knowledge that discharge is accomplished using the ADU-2S automatic pressure control when the AK-150SV compressor shifts to idle. But during daily maintenance and at halts it is recommended repeating the turn-on of the valve by pressing the "SBROS TRUB OPVT" button.

If the tank is placed in an open parking area or an unheated space, sediment must be drained from the air system moisture collector by opening the valve. Pressure in air system cylinders must be maintained within limits of 110-165 kg/cm^2. In case it increases, cylinder valves must be closed and the moisture collector valve opened. Check operation of the ADU-2S and the air pressure gauge at the very first opportunity. With pressure above the permissible value, air line depressurization is possible, chiefly at places of connections.

When shifting to a regime of winter operation turn on the device for heating "manned" compartments—fighting and driving. For this, with the hatch in the bottom of the tank open, remove the plug beneath the power unit on the right side and connect the metal-reinforced hose to the line connected with the high-pressure compressor housing. Observe caution in using the device, since the temperature of the warming air arriving may reach high values. For example, it is 330°C with a TKII rotor rotational frequency of 100 percent, or around 300°C considering its drop on the way to the end lines. The lengthy effect of high temperature has a negative effect on how crew members feel. Lengthy unmonitored operation of the device may lead to damage of ammunition charges. Therefore check operation of the device and use it with a TKII rotor rotational frequency of no more than 80 percent by turning the dual valve 3-5 turns.

Operation of the heating device air filter demands attention on the part of crew members—it cleans arriving warming air of toxic oil vapors, which is especially important when operating engines which have used up the warranty period. By this time rotor support seals are somewhat worn, in connection with which the amount of oil entering the compressed air increases. Tank maintenance instructions recommend draining sediment from the filter housing every 6,000 km in winter by turning the handle to the stop. In addition, in case of reduced effectiveness of the device, during the next daily maintenance it is necessary to clean the filtering element, with a subsequent blow-through by compressed air.

Observing the rules for operating the T-80U tank power plant under winter conditions will permit keeping its technical combat readiness at the required level, achieving the efficiency put into the design and increasing the reliability of hardware, assemblies and the vehicle as a whole.

HIGHER SCHOOL: DEVELOPMENT AND PROSPECTS

Information on Ground Troops Military Educational Institutions

95UM0324M Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 64-69

[Excerpt of article by Ground Troops Military Education Directorate: "Ground Troops Military Educational Institutions Extend an Invitation"]

[FBIS Translated Excerpt] **These days, graduates of Russian Federation establishments of general education are deciding what profession to choose.**

The Ground Troops invite young men to their military academies and schools. We pledge to provide necessary conditions for training officers of high qualification and for obtaining a higher civilian education.

Military service is covered with the aureole of romance and glory and always is prestigious for a real man. Russia needs competent, capable officers. What the Armed Forces will become tomorrow largely will depend on you young people. We hope the information provided will help you find your road to life.

MILITARY ACADEMIES

1. **Military Artillery Academy** (Command-Engineering Faculty). Engineer. Automated data processing and command and control systems; electronic instruments and devices. 195009. St. Petersburg, K-9, ul. Komsomola, 22. Tel: 542-15-71, 275-41-43.

2. **Military Academy of Ground Troops Air Defense.** Radio engineer. Radio engineering. 214027. Smolensk, 27, ul. Kotovskogo, 12. Tel: 2-65-63.

HIGHER MILITARY SCHOOLS

Higher Combined Arms Command Schools (VOKU)

1. **Far Eastern Higher Combined Arms Command School.** Engineer. Military tracked and wheeled vehicles. 675021. Blagoveshchensk, 21, Amur Oblast. Tel: 2-48-03 (Ext. 3-24).

2. **Moscow Higher Combined Arms Command School.** Engineer. Military tracked and wheeled vehicles. 109380. Moscow, Zh-380, ul. Golovacheva. Tel: 172-90-06 (Ext. 4-49).

3. **Novosibirsk Higher Combined Arms Command School.** Engineer. Military tracked and wheeled vehicles. Translator-reviewer. Linguistics. 630103. Novosibirsk, 103, Sovetskiy Rayon, Akademgorodok. Tel: 32-17-40 (Ext. 4-24).

4. **Omsk Higher Combined Arms Command School.** Engineer. Military tracked and wheeled vehicles. Sociologist. Sociology. 644004. Omsk, 4, ul. Lenina, 26. Tel: 31-41-32, 31-36-13.

5. **St. Petersburg Higher Combined Arms Command School.** Engineer. Military tracked and wheeled vehicles. 198903. St. Petersburg, Petrodvorets, 3, ul. Konstantinovskaya, 25. Tel: 427-34-88 (Ext. 3-63).

In addition to the primary military specialty (tactical command specialty of motorized rifle troops), the Far Eastern and St. Petersburg Higher Combined Arms Command Schools train officers with the specialization of naval infantry and coast defense troops; the Novosibirsk Higher Combined Arms Command School in the tactical command specialty of tactical reconnaissance and the operational-tactical command specialty of special reconnaissance; the OMSK Higher Combined Arms Command School in the specialty of sociology and organization of public-state training.

Higher Tank Command Schools (VTKU)

1. **Blagoveshchensk Higher Tank Command School.** Engineer. Military tracked and wheeled vehicles. 675018. Blagoveshchensk, 18, Amur Oblast, pos. Mokhovaya Pad. Tel: 4-45-35 (Ext. 5-84).

2. **Kazan Higher Tank Command School.** Engineer. Military tracked and wheeled vehicles. 420046. Kazan, 46, Orenburgskiy trakt, 6. Tel: 35-85-52, 35-85-72.

3. **Chelyabinsk Higher Tank Command School.** Engineer. Military tracked and wheeled vehicles. 454030. Chelyabinsk, 30, ul. Manakova, 1. Tel: 37-03-05, 36-16-03 (Ext. 3-54).

In addition to the primary military specialty (tactical command specialty of tank troops), Blagoveshchensk Higher Tank Command School conducts training with specialization in naval infantry and coast defense troops and Kazan Higher Tank Command School in the tactical command specialty of motorized rifle troops.

Higher Artillery Command Schools (VAKU)

and Higher Artillery Command-Engineering Schools (VAKIU, VVKIU)

1. **Yekaterinburg Higher Artillery Command School.** Engineer. Electrical engineering. 620108. Yekaterinburg, I-108, ul. Shcherbakova, 145. Tel: 21-90-49, 21-90-53, 27-56-49.

2. **Kolomna Higher Artillery Command School.** Engineer. Electrical engineering. 140403. Kolomna, 3, Moscow Oblast, ul. Krasnoarmeyskaya, 7. Tel: 2-81-44, 2-89-91.

3. **Kazan Higher Artillery Command-Engineering School.** Engineer. Electrical engineering. 420095. Kazan, 25, Oktyabrskiy gorodok. Tel: 76-75-46, 76-71-95.

4. **Saratov VVKIU [Higher Military Command-Engineering School] of RV SV [not further expanded, possibly Missile Troops of the Ground Troops].** Engineer. Electrical engineering. 410082. Saratov, 82. ul. Artilleriyskaya, 2. Tel: 99-96-20, 99-96-22, 99-96-38.

Higher SAM Command Schools (VZRKU)

1. **St. Petersburg Higher SAM Command School.** Engineer. Radio engineering. 197061. St. Petersburg, P-61, ul. Mira, 15. Tel: 233-70-49, 233-70-18.

2. **Orenburg Higher SAM Command School.** Engineer. Radio engineering. 460010. Orenburg, 10, ul. Pushkinskaya, 63. Tel: 41-95-07.

Higher Military Aviation (Helicopter) Schools for Pilots

1. **Syzran Higher Military Aviation School for Pilots.** 447007. Syzran, 7, Samara Oblast, military post. Tel: 7-38-11 (Ext. 1-05).

2. **Ufa Higher Military Aviation School for Pilots.** 450010. Ufa, Republic of Bashkiria, military post. Tel: 25-52-31 (Ext. 2-85).

Qualification of graduates of Higher Military Aviation Schools for Pilots: pilot-engineer.

Civilian specialty: operation of air transportation and air traffic control.

Specialization: flight operation of air transportation, air traffic control.

The Syzran Higher Military Aviation School for Pilots trains officers in combat helicopters and the Ufa Higher Military Aviation School for Pilots in transport helicopters.

Tomsk Higher Military Command School of Communications (VVKUS)

634029, Tomsk, 29, prospekt Frunze, 9. Tel: 90-52-03, 80-52-71.

Qualification: engineer.

Civilian specialties: electronic systems; communications nets and switching systems.

SECONDARY MILITARY SCHOOLS

Kirov Military Aviation-Technical School (VATU)

610041. Kirov, 41, oblast, ul. Moskovskaya, military post. Tel: 62-48-52 (Ext. 3-35).

Qualification: technician.

Civilian specialties: aircraft servicing and maintenance; servicing, maintenance and repair of electrical and electromechanical equipment; servicing and maintenance of transportation electrical equipment and automatic equipment; servicing and maintenance of transportation electronics.

Term of training 3 years.

SCIENCE. TECHNOLOGY. PROGRESS

Present, Future Tank Development

95UM0324N Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 70-73

[Article by Major General Nikolay Vasilyevich Isakov, first deputy chief of Russian Federation Ministry of Defense Main Armor Directorate: "Tanks Today and Tomorrow"]

[FBIS Translated Text] *Conclusions drawn from an analysis of today's achievements and omissions are the basis for developing ideas and plans for the near and the more distant future. In this article Major General Nikolay Vasilyevich Isakov, first deputy chief of the Russian Federation Ministry of Defense Main Armor Directorate, shares his thoughts about possible ways of further upgrading armored vehicle armament.*

Prospects for development of armored vehicles depend wholly and fully on the direction followed by the upgrading of the armament system as a whole. Therefore the question of just what it will be like in the near future can be examined only in immediate relationship with this process. Under present conditions, with the importance of military equipment growing substantially, the process of creating it has become more complicated. On the one hand, the designers' desire to constantly improve the effectiveness of armament models leads to their increased complexity, increased cost and rapid obsolescence. Time periods for developing various systems are becoming longer, which is connected with the need to use new engineering solutions. On the other hand, the uncertainty of the nature of possible combat operations demands the presence of a weapon system capable of operating under a wide range of conditions. In that situation the question of a scientific approach to its creation, development and employment acquires special pertinence.

Let us examine the directions along which the task posed is being realized. One is the traditional design-engineering direction characterized by a constant upgrading of weapon system quality through fuller use of known approaches and development of new ones. In the first case this is the use of denser configurations; an increase in accuracy of fire, power of ammunition and response speed of weapons; an upgrading of armor materials; an increase in engine volume power; and improved reliability and longevity of the system as a whole. In the second case it is the realization of fundamentally new configuration schemes of vehicles and types of engines (adiabatic and gas-turbine engine with heat-exchanger); creation of original versions of tank armament, automated target search and target designation systems, and automated command and control systems; and use of different systems of protection (active, dynamic).

Based on a mathematical analysis of the process of combat operations, the evaluation and research direction permits forecasting their course and assessing the possible outcome and resource expenditures. With its help, in addition to substantiating a rational weapon system and determining advisable time periods for replacing specific models, it is possible to identify the most promising paths of equipment development. This path is the scientific foundation, and the theory of combat efficiency and military-economic efficiency serves as its basis. After the optimum weapon system has been substantiated, it is important to realize it, i.e., to create equipment with the requisite combat performance characteristics within planned time periods, and in so doing to keep within allocated funds. These tasks are accomplished within the framework of the organizational direction, built on methods of program-specific planning.

The primary task of the combat direction is to assist in rational use of arms in accordance with their capabilities. It is connected with the upgrading of forms and methods of combat operations and of the troop organizational structure. Questions of servicing, maintenance, and storage of arms as well as training of personnel (methodology; procedure for using simulator complexes; conduct of command and staff, field, and field training exercises; interworking of combat arms) are worked out in conclusion.

Of all kinds of ground military equipment, the tank has the highest level of protection and new weapons are constantly being created to destroy it. This in turn leads to the need for a further increase in the vehicle's survivability on the battlefield, in concentration areas and on marches. In addition, an abundant nomenclature of weapons is used to combat tanks, and so they must possess high firepower. All this together gives rise to a substantial growth in vehicle weight, which affects an important characteristic such as mobility. And in order to provide it at the proper level, designers have to increase the weight of the engine, transmission and running gear. Requirements for supporting necessary average speeds, range and reliability also increase.

Thus, one of the chief conditions in creating a tank is to keep its weight within limits dictated by the possibility of employing it as a highly mobile, off-road ground vehicle adapted for being carried by various kinds of transportation and for servicing by engineer assets (ferries, bridgelayers). In addition, production of such equipment in necessary quantities requires the state to invest significant material resources.

A distinguishing feature of the tank as a structure is that the weight of the armored hull and turret presently is over half of the total weight. This indicator can be reduced by creating sturdy protection with a minimum specific weight, which necessitates new armor materials and their rational combinations. Another way is to reduce internal protected volumes by reducing the dimensions of tank components and increasing its configuration density. But implementation of these measures contradicts the need to ensure the vehicle's ergonomic requirements and accessibility of its assemblies for servicing and maintenance.

Existing limitations of tank dimensions are connected with the need for transporting it by railroad and aircraft. At the same time, requisite ground pressure can be ensured by increasing track width, and a certain hull width is necessary for rational accommodation of crew and equipment. Therefore the designers make full use of the tank's permissible lateral dimension. A further reduction in ground pressure is possible only by increasing the length of the bearing surface, but then the vehicle's maneuverability indicators deteriorate.

The growing demand for tank speed over rough terrain and its negotiation of difficult sectors predetermine an increased clearance. The hull and turret must be made higher to improve crew seating conditions. An increase in gun elevation angles can be achieved in the very same way, but introducing these changes does not permit reducing weight and ensuring good indicators of the vehicle's low signature and invulnerability.

With the saturation of tanks with automated and electronic systems (autoloader, sights, stabilizers, means of communication and coordination) and with increased external and internal loads, their design complexity grows, the cost of set-completing articles and materials for production increases, and a tendency appears for increased equipment failures for whose neutralization it is necessary to seek special means. It is also important that only highly qualified specialists can operate and service such equipment.

Designers largely follow identical paths in striving to create tanks possessing optimum characteristics. But the specifics of military doctrines of different countries dictate the difference in methods of realizing the assigned task, particularly in choice of the layout diagram, which determines the number of crew members, combat weight and fighting compartment dimensions. Thus, while the West has adopted a scheme with four crew members, three of whom are in the fighting compartment (except for the Leclerc tank), there is no loader in Russian tanks, but an autoloader is installed, which permitted substantially reducing the armored volume of the fighting compartment and the vehicle's overall dimensions and reducing its weight (the weight of Russian tanks does not exceed 50 tonnes, while the foreign Leopard 2, M1A1 and Challenger weigh 55-62 tonnes). Installation of an autoloader required use of separate-loading ammunition (for the 125-mm smoothbore gun) with a fin-stabilized armor-piercing discarding sabot projectile with high muzzle velocity (1,600-1,800 m/sec). It should be noted that up to the present time there are no autoloaders in foreign vehicles. It is planned to equip only future models with them. And the advantages of their use are obvious.

Through the weight reduction it became possible to adopt a six-roadwheel undercarriage for tanks, limit engine power, and thereby reduce the length of the engine-transmission compartment and the vehicle as a whole. In so doing, the necessary level of weight-horsepower ratio (25 hp/t) and consequently mobility was preserved. There was a decrease in the area of side and front projections of the tanks by 25-30 percent compared with western ones, which contributes to a decreased probability of them being hit by weapons and increased battlefield survivability. Which power plants are most advisable to use for tanks remains an issue. There are proponents both of the diesel as well as of the gas-turbine engine both here and abroad. A diesel was installed in the T-72 family of vehicles and a diesel or gas-turbine engine in the T-80. In using the gas-turbine engine, Russian specialists are realizing their American colleagues' viewpoint about the need to have a special FEBA armored tanker vehicle, which will permit compensating for large fuel consumption.

An important advantage of Russian tanks is the presence on them of missile weapons supporting engagement of armored vehicles and, which is especially important, fire support helicopters at ranges exceeding the range of effective fire of artillery projectiles (over 3 km). But foreign specialists assume that an antitank missile system must be accommodated on a special escort vehicle. The United States, for example, is developing such a vehicle (LOSAT) on a chassis of a medium weight category.

With respect to manning principles and fire control system characteristics, they are basically similar. Russian and western tanks use laser rangefinders and devices for automated determination of fire settings in terms of angles of elevation, for determination of their lateral lead and for input to stabilized gunlaying and turret control drives. The gunner's main sight has independent field of view stabilization (error 0.15 mrad), which increases the likelihood of detecting a target during search and the probability of hitting it during fire.

There are certain distinctions in outfitting of commander's workstation with observation and aiming devices. While the commander of the Leopard 2, Leclerc and Challenger 2 tanks has stabilized panoramic sights, in Russian tanks (as by the way also in the U.S. M1A1) the priority in detecting targets belongs to the gunner. Domestic vehicles basically use light-gathering and amplifying passive infrared night vision devices as night observation and aiming devices, and western ones use thermal-imaging devices. But despite certain advantages in target detection range, the latter also are not devoid of a number of shortcomings, the most substantial of which is their costliness.

Methods of protecting Russian and western tanks also are largely identical. In particular, multilayer composite armor, dynamic armor, and large structural angles of slope of armor plates are used. Also common is the basic principle of protection—in the most likely angles of fire from tank weapons at actual battle distances and from the most advanced and mass antitank weapons.

The level of protection of foreign tanks has been increasing in recent years basically through increased physical thickness of armor and use of multilayer barriers. A distinguishing feature of new third generation vehicles (M1A1, Leopard 2, Challenger) is the large internal volume (17-18 m^3), and their weight has reached 60 t. Our own specialists are giving primary attention to increasing the configuration density and miniaturizing internal assemblies. They succeeded in providing a level of protection close to the foreign level, and the weight of the vehicle was 40-46 t.

The overall world trend toward further tank development is determined by a number of military-engineering, technological and economic factors. The number of tanks being manufactured is being sharply reduced and a transition is occurring from developing new designs to modernizing existing ones under conditions of the reduced level of confrontation of leading world powers and reduced volumes of military production financing. It is assumed that chief attention should be given to increasing vehicle protection against precision weapons (above all through use of systems of countermeasures against guided and homing weapons), creating jamming systems and decoys, and reducing detection signatures in all bands.

The overall viewpoint of specialists of the majority of countries is that weaponry will be developed in the direction of increased accuracy and fast response through automation of the detection, identification and selection of targets and of loading. In solving these problems, foreign specialists propose to create a new tank base (crew of three, reduced volume, reduction of weight to 50-52 t.), which is a very difficult and costly task. Russian designers already have a sufficiently developed small-scale base and so can upgrade the vehicle along an evolutionary path.

The opinions of experts of leading tank-building countries also coincide that it is necessary to install automated control and monitoring systems in tanks which will be able to receive and process battlefield information in real time and carry out data exchange and target designation. Presumably the first such systems will appear in the late 1990's. Creation of a family of armored vehicles on standardized chassis is considered a promising direction.

GLONASS Global Satellite Navigation System

95UM0324O Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 74-77

[Article by Colonel Mikhail Lebedev, chief of GLONASS Scientific Information Coordination Center: "GLONASS: Accuracy, Reliability, Promptness: Navigation From Space Is Realistic and Profitable, and Not Just for the Military"]

[FBIS Translated Text] The epopee of development of satellite navigation systems began with the launch of the domestic Kosmos-192 spacecraft, which was placed in a circular orbit 750 km high in November 1967. Tests of this spacecraft concluded in 1970, after which the Tsikada space navigation system was created and placed into operation (1979) in support of the Navy. It now includes four such spacecraft. Since 1990 it has been open also for nonmilitary users, i.e., captains of civilian vessels received the opportunity of determining their position at any point in the World Ocean every 1.5 hours with an error of 80-100 m. Now Tsikada together with the American-French-Canadian SARSAT system is part of a unified international search and rescue service, KOSPAS-SARSAT.

But wide-scale use of space navigation capabilities probably became realistic only with creation of the global satellite navigation system (GLONASS). It began to be

developed back in the mid-1970's, and the first satellites already were launched in 1982 (Fig. 1).

By the way, GLONASS (like the similar U.S. NAVSTAR system) initially also was intended for satisfying requirements for navigational support only of military users. With its help, nuclear powered missile submarines can determine their position at any time and at any point without coming to the surface (it is enough only to extend a receiving antenna). This is necessary in particular for inputting launch point coordinates of intercontinental ballistic missiles to the mission and adjusting their trajectory. In aviation the data coming from GLONASS permits increasing the likelihood of detection, lock-on and destruction of targets (with fewer of its own losses) because of an accurate approach to them when flying at low altitudes or along a selected irregular route (optimum for penetrating the enemy air defense system). On the whole, use of GLONASS leads not only to reduced expenditures for costly guidance equipment, but also to increased effectiveness of engaging both stationary as well as moving targets. Even with the release of free-fall bombs, higher hit accuracy is achieved when data on the platform aircraft's speed and coordinates are input to the bombsight computer.

Without navigation from space the creation and employment of precision weapons (including cruise missiles) and reconnaissance-strike complexes making up the basis of firepower of present, let alone future armies, would be problematical. But the fact is, there also are other areas of application of the space navigation system—reconnaissance and navigation support to Ground Troops units and subunits. For example, how is it possible to imagine Mobile Forces operations in unprepared TVD's [theaters of military operations] without their precise self-determination of their location in real time? GLONASS gives them that opportunity both in executing a maneuver and moving to given positions as well as immediately in the course of combat operations. In the Persian Gulf war even the individual tank crew or soldier of the allied troops supplied with miniature receiving gear of the NAVSTAR system determined their coordinates practically instantaneously with an accuracy to several meters. In addition, in the assessments of U.S. specialists, 90 percent of all data on the location of enemy weapons and subunits was obtained with the help of that same system.

And finally, unique characteristics of space navigation systems permit using them in the national economy, such as to solve fundamental geodetic problems, and without any detriment to national security interests. In addition to marine navigation, even now GLONASS also can be used in support of the Air Force, such as to support an aircraft's "blind" landing, inasmuch as it

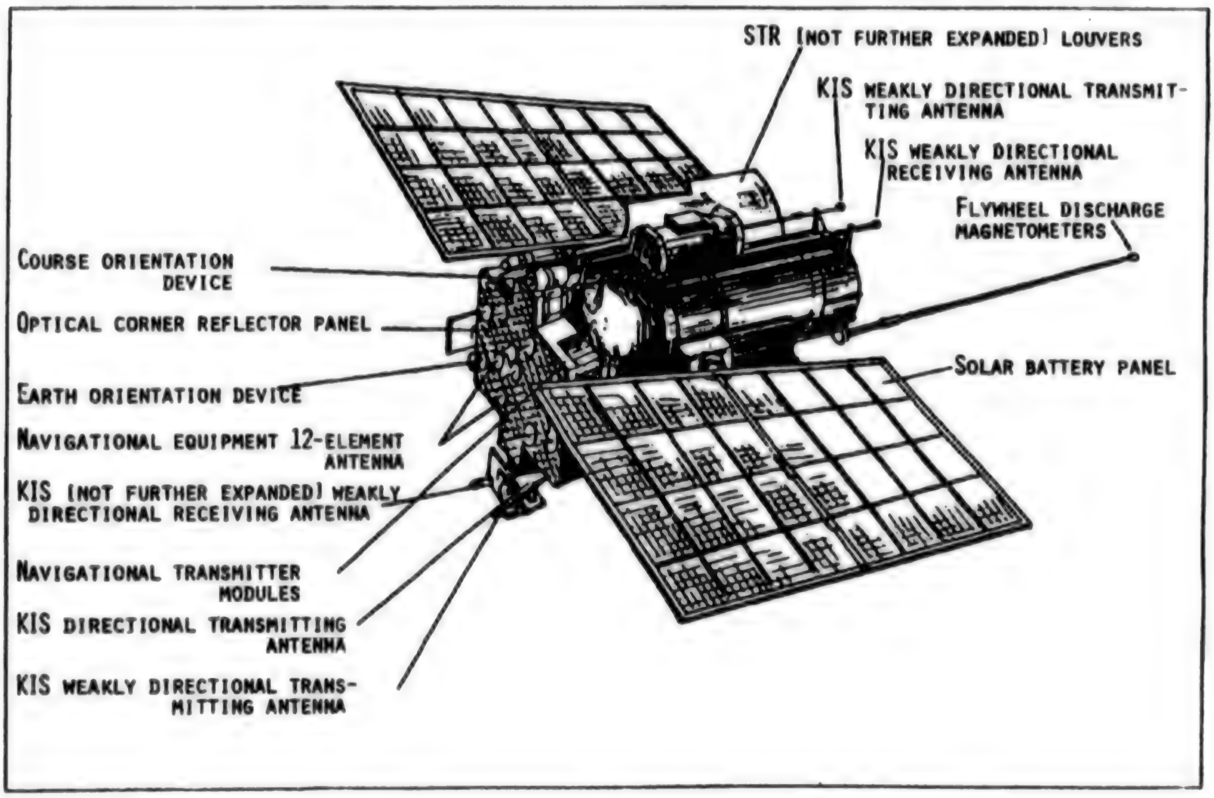


Fig. 1.

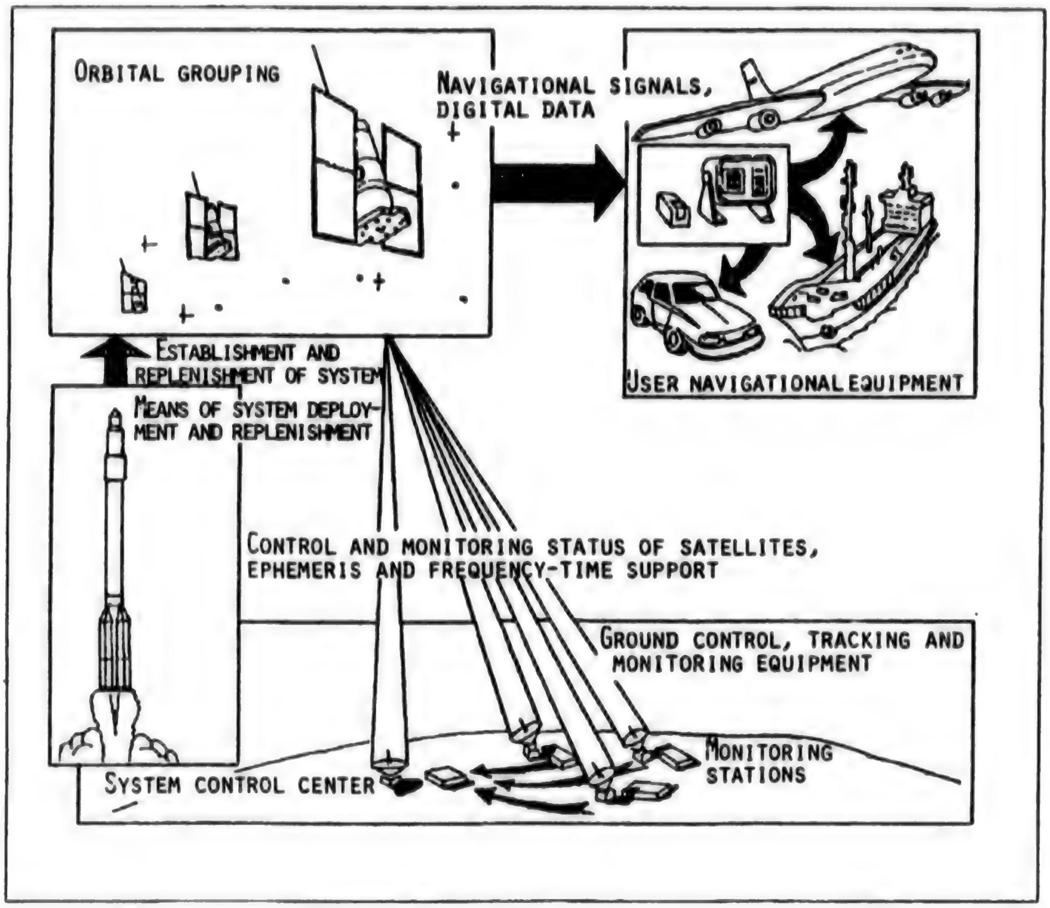


Fig. 2.

permits determining its position in a three-dimensional coordinate system relative to the landing strip with an accuracy to a meter, as well as level speed and vertical velocity. Navigation from space considerably eases the work of geologists, builders and even... automobile drivers. With a space navigation system receiver and computer, the latter can completely forget about tracking their own movement route. As we see, the most varied organizations are interested in operation of such systems. This is a guarantee not only of their self-repayment, but also profitability.

Well, just what is GLONASS? It includes (Fig. 2) means of deployment and replenishment; an orbital grouping; a ground control, tracking and monitoring complex; and user navigation equipment. The system client is the Russian Ministry of Defense. The Military-Space Forces operate and control its subsystems.

Means of deployment and replenishment are intended for prelaunch preparations, for inserting GLONASS spacecraft into planned orbits and for maintaining their necessary numbers for uninterrupted functioning of the entire system. The orbital grouping is established by launching modules of three spacecraft in the orbital plane, which then separate according to a given program. Launches of Proton booster rockets are made from the Baykonur Space Launch Center. This grouping is located in three orbital planes displaced 120 degrees relative to each other. There are eight spacecraft in each plane and the distance between adjacent ones is 45 degrees. The orbital altitude is 19,100 km. Thus, the entire orbital grouping of a completely deployed GLONASS consists of 24 spacecraft (Fig. 3). That number of satellites with the indicated disposition is optimum for creating a continuous navigational field around the Earth.

The ground control, tracking and monitoring complex receives telemetry from satellites and forms and transmits special data to them.

User equipment includes navigational receivers, which permit performing applied tasks in support of air, water and ground transportation, geodesy and cartography, as well as systems for common timing and metrology and for environmental protection.

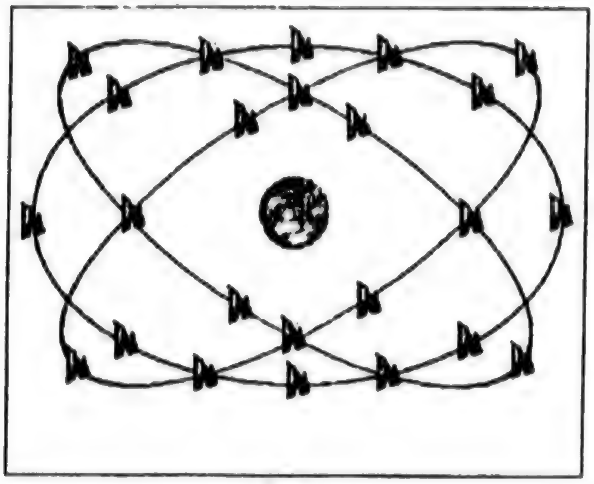


Fig. 3.

The principle of GLONASS operation is based on precision space-time tie-in of elements of the orbital grouping through continuous communication of data to subscribers (over a radio channel) on the spacecraft's coordinates and on the Coordinated Universal Time scale. The user's receiver automatically (in a noninterrogation mode) measures the distance to four (or three) GLONASS spacecraft and their speed (the GLONASS orbital grouping numbers over 20 spacecraft, and at least three are within direct radio communications line-of-sight of any user at any point in time). In parallel with the conduct of measurements, digital data contained in the makeup of the navigational radio signal of each GLONASS spacecraft is extracted, which describes its position in space in a time scale common to the entire system. Processing the data received according to a special algorithm permits determining three (two) position coordinates and three (two) of the user's velocity vector components. Accuracy of determinations in the "coarse" mode is 100 m in plane coordinates, 150 m in height, 15 cm/sec for velocity vector components, and 1 microsecond is the correction to the Coordinated Universal Time scale.

Constantly growing demands for accuracy, promptness and reliability of navigation dictate the need for upgrading GLONASS, especially for improving accuracy of navigational determinations. For example, it is proposed to use a differential system operating mode in which measurements are made simultaneously by several receivers separated from each other by a certain distance. When results of these measurements are compared, so-called differential corrections are formed, which improve the accuracy of navigational-time determinations to centimeters and nanoseconds.

Countries of the European Community are showing special interest in GLONASS. Civilian users from these states do not wish to become fully dependent on the one NAVSTAR satellite navigation system, which is under the purview of the U.S. Defense Department. Moreover, our system is by no means inferior in characteristics to the American one. Fig. 4 shows results of tests (in meters) in 1994—NAVSTAR (a), NAVSTAR-GLONASS (b) and GLONASS (c). Therefore joint use of NAVSTAR and GLONASS is planned even now, and specialists of the Military-Space Forces Scientific Information Coordination Center are working on this. The Center's tasks also include increasing the effectiveness of using the space navigation system and the newest technologies, organizing interworking with users, providing them with information and scientific-methods services, and assisting international cooperation in the space area.

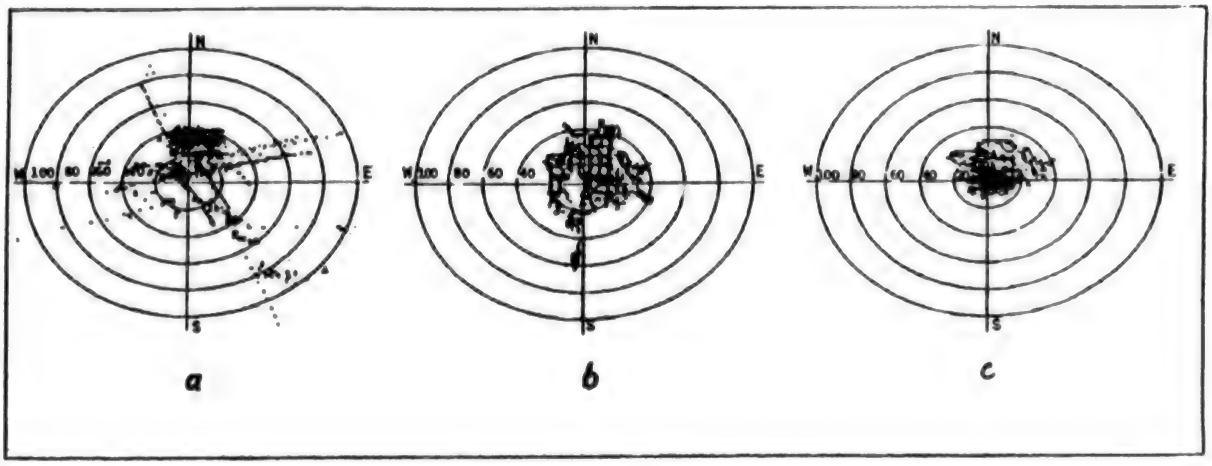


Fig. 4.

Shturm-S Self-Propelled Antitank Missile System

95UM0324P Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 78-79

[Article by Major Sergey Samoylyuk: "Antitank Revolver"]

[FBIS Translated Text] The experience of local wars and conflicts indicates that opposing sides make wide use of tank and mechanized groupings. In this connection it is difficult to overestimate the importance of antitank weapons, and above all guided missile systems, to the defense. They are capable of disrupting or considerably weakening an enemy attack.

The 9P149 Shturm-S self-propelled antitank missile system, unique in its technical characteristics, is just such a weapon.

It was demonstrated openly for the first time in 1992 at the Russian International Trade Center. Special interest was generated in specialists by the fact that tanks, moving armored vehicles, small ground targets (permanent emplacements, earth-and-timber emplacements) and slow, low-flying airborne targets can be engaged effectively with its help. It also must be noted that during a demonstration at an exhibition in the city of Oman (Saudi Arabia), the Shturm-S complex made 24 ATGM launches and all missiles reached the targets precisely.

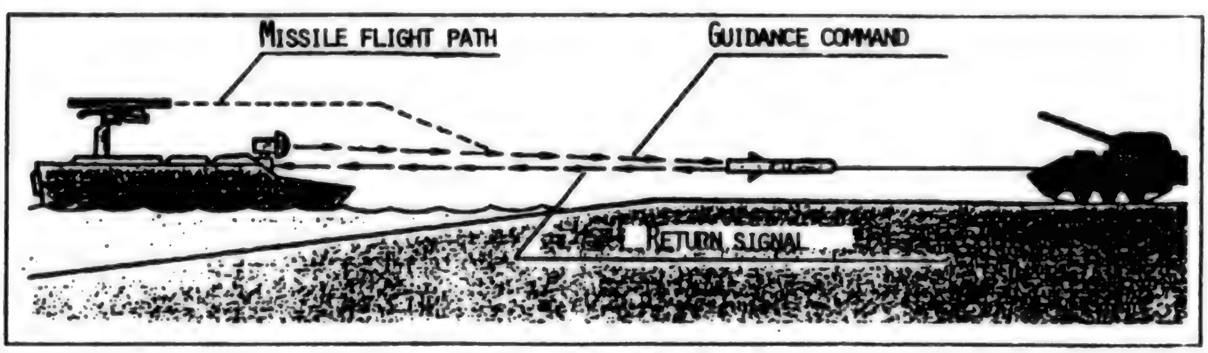
An important feature of the complex is its launcher. In a traveling configuration it retracts within the vehicle hull, where the battle stowage mechanism is accommodated. The latter is a rotating drum with reduction gearing (like a revolver). Twelve launch canisters with missiles are mounted on its supports. Before firing, the launcher (mechanical "arm") grips a launch canister and deploys it. After launch, the used canister is discarded and a new one is automatically moved from the drum onto the line of fire. Only one second is spent on the entire operation.

The Shturm-S antitank complex differs favorably from many foreign-made combat systems (such as the U.S. TOW and French HOT). It is made in a modular design, which permits accommodating it on any types of BMP's, BTR's, tanks and helicopters, both Russian as well as foreign. It has a semiautomatic missile guidance system with commands transmitted over a radio link. Such engineering solutions contained in its design are still only being mastered by foreign firms. The majority of similar western antitank missiles have guidance systems based on transmission of commands over wire, and so their range and airspeed are limited (they do not exceed 4,000 m and 200 m/sec respectively).

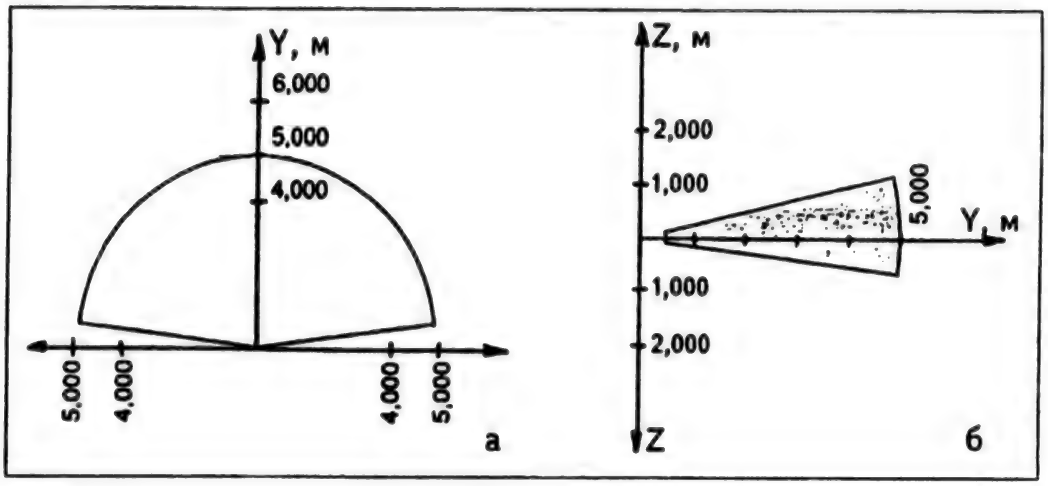
The base chassis for accommodating the equipment and unit of fire is the MT-LB multipurpose light armored combination prime mover-carrier, which has given a good account of itself in the Russian Army. Its high thrust-to-weight ratio, the presence of tracked propulsion, and low ground pressure permit using the complex effectively under various natural-climatic conditions, including the desert, mountainous terrain, and off roads. The configuration of launcher and other equipment enables the fighting vehicle crew to conduct fire from an open position, a prepared emplacement, and from the water's surface with the MT-LB moving afloat. This favorably distinguishes the Shturm-S complex from similar systems based on wheeled chassis.

The prime mover's low silhouette (the height at the roof does not exceed 1.8 m) and low center of gravity permit its use on steep slopes. Thus, at the demonstration of the Shturm-S fighting vehicle in Oman it drove up such steep upgrades (elevations) that the British specialists present were astounded.

The 9M114 multipurpose guided missile with single shaped-charge warhead is used in the Shturm-S complex. The ATGM is made with a canard aerodynamic configuration with folding forward fin assembly and semicircular wing, which is pressed to its cylindrical body in a nonworking position. It uses a solid-propellant dual-regime sustainer engine supporting a high airspeed (up to 530 m/sec). Armor penetration of the 9M114 guided missile is 560-600 mm. The ATGM is equipped with a booster stage, which ensures its reliable exit from the fiberglass transport-launch canister. The latter's design is such that the missile is given a rotary motion on exiting it. In addition, the missile can be stored in the canister at least ten years.



Guidance of missile to target



Kill zones

Key:
a. In horizontal plane b. In vertical plane

Shturm-S also can be fitted with the 9M114F guided missile with high-explosive warhead. This enables destroying enemy personnel, permanent emplacements and other engineer structures, including in mountainous terrain. In connection with the appearance of tanks with dynamic protection, the designers created a new missile with tandem warhead that is competitive on the world market. Specialists note that the modernized missile possesses an increased flight range and is capable of a guaranteed hit on tanks behind the dynamic protection, penetrating armor equivalent to 800 mm of homogenous armor.

The missile guidance system is semiautomatic radio-command with an infrared tracking signal. It has high noise immunity through the use of two special codes and five fixed frequencies during missile guidance. The fact also should be noted that it is impossible for technical equipment to employ radio frequency jamming against the missile, which has supersonic speed.

Reliability of hitting targets essentially is ensured by automatic equipment, and the operator's task consists only of lining up sight crosshairs with the target. Even an unskilled specialist can perform such work.

Special fire control programs have been developed, because of which the missile flies along a trajectory above the line of sight in the initial phase and on approaching to within 500-700 m of the tank it descends and hits the target. This enables the operator always to see the target of engagement regardless of weather conditions and operation of missile motors. At maximum range of fire the accuracy of the ATGM guidance system does not exceed 0.6 angular minutes. This permits bringing fire on any small armored targets and even helicopters in a hover and approach mode. Maximum altitude for engaging airborne targets (launch at sea level) is 3,000 m.

The antitank missile complex is equipped with a system of crew protection against casualty-producing elements of mass destruction weapons. It includes an air filtration and ventilation system, chemical and radiation reconnaissance instruments, and hull pressurizing devices. In addition, Shturm-S has communications equipment with a range up to 40 km and night vision devices.

The high combat capabilities of the complex can be realized with reliable operation of all its systems and cohesive crew actions. Special training simulators and training mockups of missiles have been created for training combat teams and maintaining their proficiency. With their help it is possible to train personnel under classroom conditions quickly and effectively without using engine time and ammunition. The complex includes monitoring and inspection vehicles for its servicing and maintenance and for performing periodic technical inspections.

AT YOUR REQUEST

Low-Orbiting Multisatellite Communications Systems

95UM0324Q Moscow ARMEYSKIY SBORNIK in Russian No 2, Feb 95 (signed to press 25 Jan 95) pp 88-91

[Article by Colonel Nikolay Feoktistov, candidate of technical sciences, Lieutenant Colonel Mikhail Lakomov, candidate of technical sciences, Lieutenant Colonel Aleksandr Chuyko, candidate of technical sciences, and Lieutenant Colonel Aleksandr Digoran]

[FBIS Translated Text] *Dear Editors!*

I command a space communications station. Unfortunately, there is little training literature on organizing satellite communications. One basically has to use only technical documentation on the gear and instructions.

My colleagues and I would like to become acquainted in the journal's pages with the experience of training "space" specialists and with prospects for development of systems and complexes of such communications, particularly with low-orbiting space relay groupings.

Senior Lieutenant Andrey Sokolov, Station chief, Moscow Military District

In fulfilling our reader's request, we plan to tell subsequently about the role and importance of satellite communications in the Armed Forces command and control system, methods of improving its reliability and survivability, the expansion of functional capabilities, principles of building satellite communications networks and other innovations. In addition, we will generalize in our pages foremost experience of training specialists and their work in special tactical problems and drills for providing commanders and staffs with stable satellite communications.

In recent years Russian and foreign specialists have been paying great attention to low-orbiting multisatellite communications systems (MNOSS) both for peaceful as well as military purposes. This is fully explainable, for they have clear advantages over spacecraft in geostationary and highly elliptical orbits: specifically, a short time period for developing and establishing a highly survivable orbital grouping, the possibility of launching spacecraft from mobile launchers, and small subscriber stations convenient to operate.

MNOSS for global and regional communications are distinguished depending on the territory serviced. They are broken down in turn into subsystems of continuous communications with direct and intersatellite relay of signals, and relay subsystems with storage.

The lower limit of the orbit is advisable from 400 km, which precludes the effect of the atmosphere on spacecraft; otherwise it is difficult to ensure a lengthy period of the satellites' ballistic existence. And to weaken the effect of the Earth's natural radiation belts on them to the maximum extent, the upper limit must be confined to an altitude of 1,500-1,600 km.

MNOSS groupings are built according to the principle of satellite "rings," each of which consists of several spacecraft moving in near-circular orbits. They are in the same orbital plane and form a communications "belt" on the Earth's surface (Fig. 1). A feature of their placement is that with fulfillment of the condition $i > 90°\text{-}b$ (where i is orbital inclination, b is angular radius of the radio communications line-of-sight zone), the satellites pass over any point of the globe as a minimum twice in 24 hours. The spacecraft move along identically inclined orbits. They are stable and can be operated successfully for a lengthy time. Failure of one satellite's operation will not lead to lengthy interruption in communications. Also of no small importance is that it is possible to service subscribers over large territories.

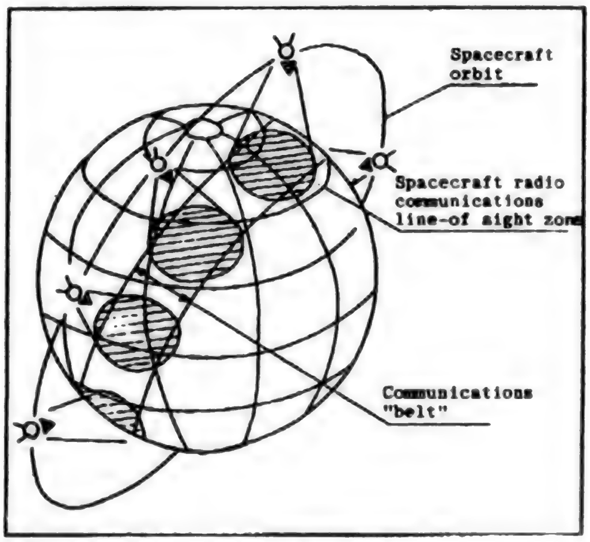


Fig. 1. Diagram of formation of a communications "belt"

Because of the small radius of radio communications line-of-sight zones (see table), a large number of satellites are needed for global communications systems (numerator). Their number decreases slightly for regional systems (denominator). The table also shows the number of spacecraft (N_{kc}) and the number of orbital planes (m) for building each of the systems depending on orbital altitude (H_{kr}) and permissible angle of elevation (γ).

Orbital Altitude (km)	γ10°		γ15°		γ20°	
	m	N_{sc}	m	N_{sc}	m	N_{sc}
500	8/7	128/126	10/9	190/180	12/11	276/264
750	6/6	78/72	7/7	119/105	9/8	153/136
1000	5/5	55/55	7/6	72/72	7/7	105/98
1250	5/4	45/40	5/5	60/55	6/6	78/72
1500	4/4	36/32	5/4	50/48	5/5	65/55

But the MNOSS are inferior to high-orbiting systems in certain things. The shortcomings include a limited radio communications line-of-sight zone (its diameter is approximately 2,000-6,000 km), short duration of the communications session (10-15 minutes), and frequent interchangeability of satellites in the subscriber's operating zone. In addition, their high angular speeds somewhat hamper use of narrow-beam antennas. Therefore it is best to use antennas with a radiation pattern width of from 120 to 180 degrees. Inasmuch as in the course of its movement a spacecraft also passes over ocean areas where there are practically no subscribers, the equipment functions on idle for more of the time. Finally, these systems have not yet been adapted for supporting communications in limited territories.

The makeup of a low-orbiting system includes the missile-space complex and the communications system. The latter consists of the following elements (Fig. 2). The main coordinating body is the control center, which plans and coordinates the work of deploying and operating the spacecraft grouping, the functioning of communications system elements, and evaluation of channel quality and condition of technical equipment. The center interworks with a similar body for controlling the flights of satellites.

Relay control centers organize the following: subscriber access to the communications system; control of data flows; interfacing with common-user telephone networks and other communications systems; collection and distribution of data coming over ground channels; keeping subscriber catalogues; and exchanging technological data with the communications system control center.

The onboard relay system processes radio signals. It also can be given functions of the relay control center.

Crosslink communications are intended for communications and real-time data transfer over enormous territories.

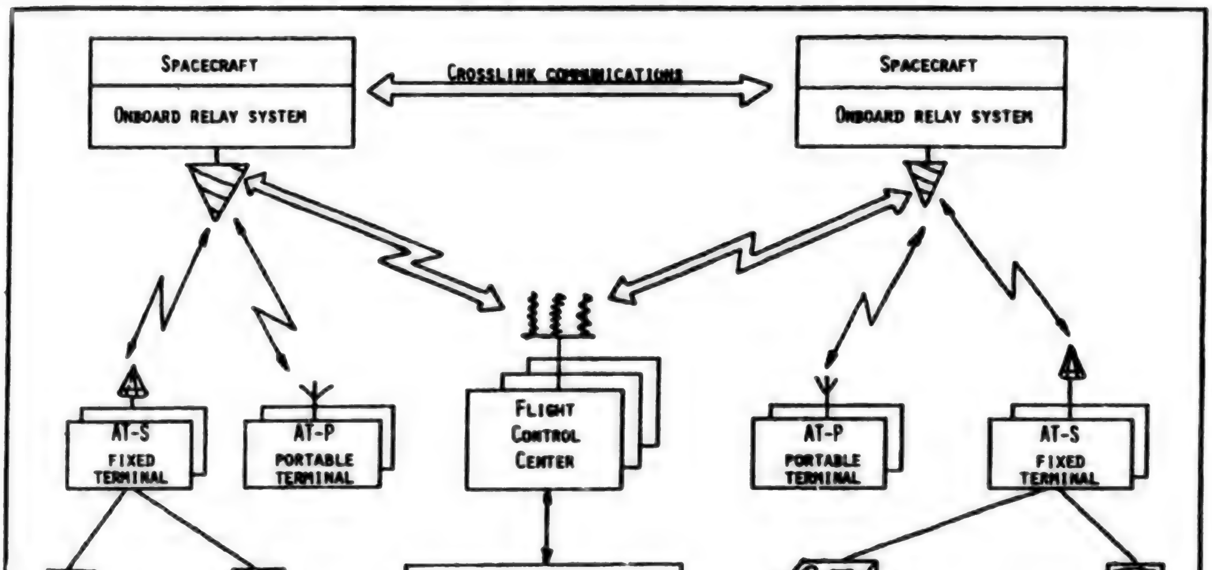


Fig. 2. MNOSS structural diagram

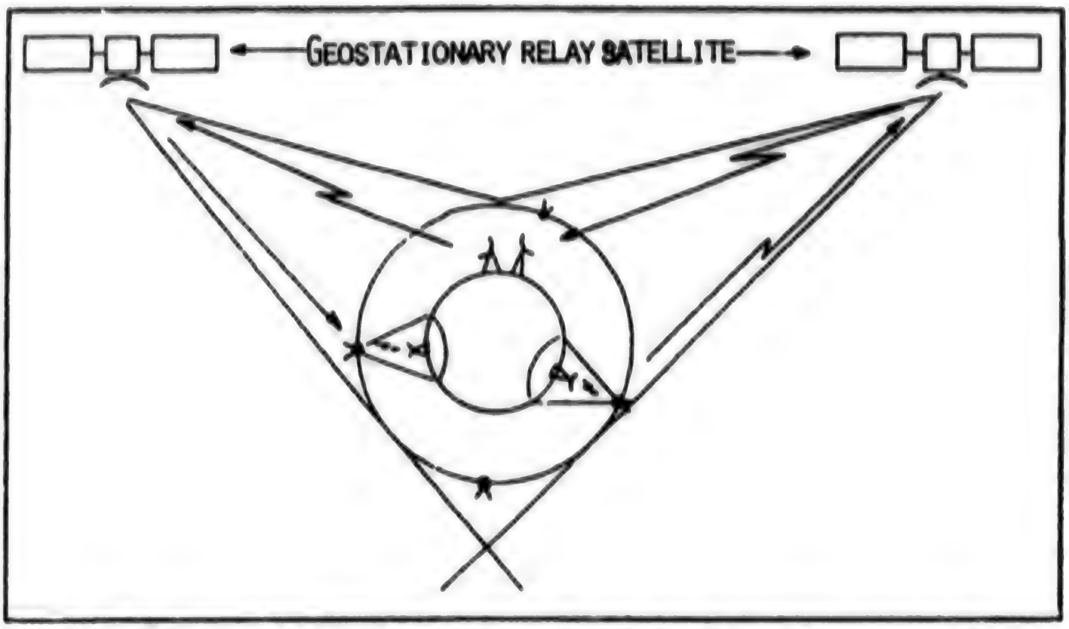


Fig. 3. Diagram of MNOSS with data transfer and relay via geostationary spacecraft

Ground stations include terminals for individual access (AT-P—portable) and group access (AT-S—fixed).

Now let us examine how communications is accomplished in the MNOSS.

It is common knowledge that in systems with data transfer, satellites do not provide a continuous view of the service area. Therefore communications between subscribers is maintained by two methods: direct relay and signal transfer.

In the first case communications is possible only for subscribers in the radio communications line-of-sight zone of one spacecraft. And the length of the session of conversation between subscribers is determined by the distance between them and orbital altitude, and the frequency of sessions is determined by the number of satellites and the structure of their grouping.

In the second case a transmitted message is stored aboard a satellite, and when it passes through the zone of the addressee's location the message is dumped to him. The message must have an address part, the so-called subscriber identification. This means special steps must be taken to ensure reliability, particularly receipting for the correctness of information received and retransmitting data.

In this case the delivery of messages can be regulated. This task is performed by the relay control center, which, having received the data, sends it off on the route, i.e., determines to which spacecraft to transmit the message in order to deliver it to the subscriber in minimum time.

One relay control center can be activated only when satellites are deployed in polar and near-polar orbits, i.e., when it "sees" all orbital planes simultaneously. But if the spacecraft are in other orbits, then the number of centers interconnected by communications links increases. This is done in order to transmit data promptly. If for some reason this condition fails to be fulfilled, it is possible to use high-orbiting (geostationary) satellites.

Here the communications system functions as follows (Fig. 3). A message received by a low-orbiting spacecraft is transmitted over crosslink communications to a geostationary relay and is dumped from it to the relay control center. Here the message is processed and the delivery route is planned, then the message is transmitted from the center or via a relay satellite to the appropriate satellite in the MNOSS. As a result, the time for delivering data to a subscriber is shortened considerably. Because of limited capacity of such space communications links, they are used only for transmitting urgent messages.

Systems organized with the help of crosslink communications are the most promising. They permit setting up global data exchange networks in which messages are transmitted essentially in real time. The number of users increases to several hundred thousand.

One manages to cope with many difficulties which arise in establishing an MNOSS of such a type, but the most difficult problem is to ensure prompt, optimum routing. The chief problem here is the frequent change of network topology and the constant displacement of spacecraft relative to ground subscribers.

Experience shows that in developing route algorithms it is advisable to use wave methods and methods based on a priori knowledge of the called subscriber's geographic coordinates.

Wave methods are based on transmission of a packet of messages (subscriber search signals and circular and control data) to each visible relay satellite in a global or local zone. It is undesirable to transmit several packets simultaneously.

As of today, two concepts have been developed for building a communications system using crosslink communications, in which the main role belongs to relay control centers or spacecraft.

Under the first concept the relay control center is assigned tasks of providing subscriber access to the net, regulating data flows and interfacing with other communications nets. Each center organizes system functioning in the assigned service zone. Under the second concept these functions are performed by relay satellites and the relay control center resolves interface problems.

An analysis of MNOSS capabilities shows that it is advisable to use them as a supplement to existing communications systems. Today there is a demand for communications services which could be satisfied by low-orbiting multisatellite systems, particularly providing a prompt data exchange (including telephone communications) of subscribers located in regions that are remote or difficult of access with a poorly developed communications infrastructure, and in areas of natural disasters and extraordinary incidents. Also of no small importance is that here it is possible to serve a large number of low-power subscribers on a global scale.

Systems also can be used in hydrometeorology. They collect data from attended and unattended sensors of ecologic monitoring systems and dump messages to regional stations; notify appropriate services and organizations about disasters; collect data in systems monitoring the state of oil and natural gas pipelines, transmit it between ecologic monitoring centers and so on.

The MNOSS also is of interest for workers in production, commercial, medical, scientific and educational spheres. They also will help in the work of standardized services—electronic mail and document exchange—and will provide access to remote data bases and terminals.

The MNOSS can be used successfully in support of the Armed Forces for communications with reconnaissance and raiding subunits operating in the enemy rear; for monitoring military cargo movements; for collecting data from automated reconnaissance equipment; for relaying data from unattended buoys of submarine tracking systems in polar latitudes; for redundancy of high-orbiting satellite communications systems and so on. And the spacecraft can be launched from mobile launchers, which will substantially improve survivability of the communications system under conditions of combat operations.

IN FOREIGN ARMIES

Low-Flying Target Detection Options Discussed

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[Article by Lieutenant Colonel Aleksandr Manachinskiy, candidate of military sciences, and Lieutenant Colonel Vladimir Chumak, candidate of technical sciences: "Sit High, Look Far?"]

[FBIS Translated Text] *Specialists abroad view the problem of combating low-flying targets as one of the main and most difficult ones for air defense. In recent years military departments of leading world countries have been liberally financing scientific developments for creating integrated air defense systems capable of minimizing the threat of enemy air strikes against troops and installations from low and extremely low altitudes.*

Certain difficulties arise when ground air defense weapons combat airborne targets using low and extremely low altitudes. They are connected above all with a limitation of the range of target acquisition, tracking and identification, which considerably shortens time for decisionmaking and commencement of fire by air defense systems. The radar radiation pattern is distorted due to the effect of nonuniformities of the underlying surface. In addition, a weak echo is reflected from the target and has to be discriminated against the background of powerful re-emissions from local features and hydrometeorological formations, sporadic reflections from flocks of birds or dielectric nonuniformities of the atmosphere. Loss of tracking is caused by mirror reflections of radar signals from the earth's surface. On entering the radar's receiving channels, they are processed as signals from a target.

Air defense system designers assume that it is possible to improve existing radars and also create fundamentally new means of detection, including those using different physical principles of functioning. For example, in the late 1960's it was considered possible to increase the range of radar line of sight most effectively only by placing the radar at an altitude of 6,000-9,000 m, which was supposed to provide a view of air space for several hundred kilometers. Such an approach was used in developing the Hawkeye and Nimrod airborne radar early warning systems. But with the concept's seeming simplicity, it proved no simple matter to implement inasmuch as it was necessary to organize an integrated air defense command and control and communications network and provide for centralization and precise coordination in the operation of all peripheral systems. As a result, the cost of the project threatened to exceed all reasonable limits.

Another version of a solution envisaged elevating the radar above the earth's surface using dirigibles or tethered balloons. The cost of such systems and expenses for

maintaining them would be less and they could be in the air incommensurably longer compared with aircraft systems. A third and even simpler and cheaper method of increasing radar line of sight range also was examined: raising not the entire radar, but only its antenna system, on a special mast.

Firms developing radars are giving great attention to improving radar image quality against the background of the signal's reflections from various obstacles and nonuniformities of the atmosphere. In particular, moving target indication [MTI] systems, one of the principal means of neutralizing passive interference, are being upgraded. The majority of existing MTI systems (with internal or external coherence and with compensatory or spectral suppression method) reduce radar range by 10-20 percent. This occurs because of additional losses of the legitimate signal caused by intermediate-frequency amplitude limitations and by its non-optimal processing.

Taking this circumstance into account, foreign developers make wide use of digital filters and adaptive interference compensators and use the fast Fourier transform method for signal processing. In the assessments of experts, this provides a passive noise suppression factor within limits of 20-60 db depending on the width of its energy spectrum and doppler shift of the signal reflected from the target.

Foreign specialists deem it possible to upgrade MTI systems by using a coherent sequence of spread-spectrum sounding signals (nonsinusoidal signals or in the form of Walsh or Haar functions) with intrapulse modulation. This presumably will permit increasing the range and noise immunity of radars. Accuracy and resolution will increase simultaneously and the false alarm level stabilization quality will improve.

It is planned to accompany such a modification by replacing or supplementing traditional comb filters with narrowband doppler filters realized using a discrete or fast Fourier transform. By ensuring control of the compensation level threshold value, it is possible to achieve constancy of false alarms at the output of each system resolution element and adapt to the interference environment. Using the fast transform in adaptive correlated-noise suppressors will improve the process of radar surveillance of objects under the simultaneous effect of different passive interference.

It is believed possible to suppress strong interference reflections without introducing limiters to radar receivers and to detect stationary objects in interference-free zones by using narrowband filters. In discriminating signals with zero doppler frequency, such a filter forms an interference map containing data on the mean echo level in each resolution element. Correlating the reflected signal between scans permits discriminating objects moving at certain speeds and eliminating reflections from flocks of birds and moving ground objects. It is not necessary to resort to widening the band of frequencies suppressed by doppler filters. In the quasi-continuous method of detection and ranging, it is permissible to change the outgoing pulse repetition frequency to eliminate the effect of "blind" speeds (doppler frequencies at which it is impossible to realize a target speed measurement).

The introduction of superhigh-speed computers and microprocessors will help to improve signal processing methods and to automate processes of detection and measurement of parameters of the movement path of airborne objects. This will permit creating distributed computer structures, which will improve accuracy and speed of data extraction and conversion and will improve the equipment's reliability and survivability characteristics. Along with use of solid-state elements in electronic circuits, the intensive introduction of microprocessor engineering to radars realizes the possibility of simultaneous coverage of all electronic equipment units with a built-in monitoring system. Thanks to the latter's presence, it is believed the time for restoring a radar after failures or damages will be shortened to 20-40 minutes.

The use of high-directional phased array systems with a low sidelobe level will substantially limit the effect of passive interference and the mutual effect of adjacent radars. For example, the antenna of the AN/TPS-70 Westinghouse 3-D radar is a planar array whose ultralow sidelobe level is provided by computer control of the operation of slot radiators over its entire aperture area. It is planned to exclude the effect of local features and penetration of interference by adapting the array's operation to specific detection and ranging conditions. The foreign press reported that noise suppression was achieved in an experiment at a level greater than 50 db with a 5 MHz bandwidth.

In the estimate of foreign specialists, new-generation SHF-band radars have rather good prospects for detecting low-flying targets, although they will experience certain difficulties in determining the class of airborne targets. Without their reliable identification in compressed time periods, the combat potential of active air defense weapons may be used ineffectively. Therefore primary hopes are linked with use of EHF-band radars, particularly with operating frequencies of 35 and 94 GHz. For example, the French firm of Thomson-CSF is creating a "family" of target tracking radars in the 35 GHz band (their common name is Dagger) for use together with a 23-mm coaxial gun. This same firm is working on a radar for the Navy intended for tracking low-flying antiship missiles in the 94 GHz band.

A surveillance radar will appear in the very near future capable of identifying airborne targets by comparing their radar signatures with data on size, shapes, characteristic surface elements and doppler frequency spectrum stored in the onboard computer memory.

Alternative approaches in the area of detection and ranging are being studied and the HF (10-100 m) radio frequency band is being developed abroad. HF radio

frequencies are capable of propagating beyond the line of the visible horizon both by bending around the earth's surface and as a result of ionospheric refraction (surface and sky waves). The effective range of the over-the-horizon radar using a surface wave may reach 200-300 km, which exceeds by 4-6 times the line of low-altitude target detection by SHF-band radars. In using the sky wave, the radar operates according to the principle of oblique incidence-backscatter sounding and is capable of detecting targets at a distance of 400-800 km with one-hop wave propagation. The multiple-hop mode is realized with several successive re-reflections of the wave from the ionosphere and earth's surface. In this case it will become possible to "move the detection line back to 4,000 km.

Passive IR systems are being created for stable operation under conditions of intensive electronic countermeasures or for covert functioning in periods of radio silence. They use thermal energy emitted by elements of the target structure in contrast with the terrain's natural thermal background. Operating wavelengths of such thermal imagers lie in the 8-15 micron range, which corresponds to emission resulting from aerodynamic warming of fairings and the wing leading edge and to emission given off by the target's engine nozzle. IR systems permit acquiring targets around the clock, have good resolution in terms of dynamically changing angular coordinates of low-flying objects, and support their identification based on the nature of the emission spectrum. The FLIR system, for example, has the enumerated features.

Nevertheless, the dependence of IR systems on weather conditions limits their use in rain and dense clouds, inasmuch as range is substantially reduced. At the same time, IR radiation penetrates fog and haze better than beams of the visible spectrum. As a result, the thermal-imaging system's target detection range exceeds visual range by 3-6 times. Inasmuch as a passive IR system does not support target range measurement, a laser rangefinder is a necessary supplement. Foreign military specialists believe this combination will be one of the most effective alternatives to enemy electronic countermeasures equipment.

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